June

RADIO AND HOBBIES IN AUSTRALIA

VOL. 1 No. 3

In this issue

A "WIRELESS WEEKLY" PUBLICATION

Helping Good Servicemen to do Better work . . .

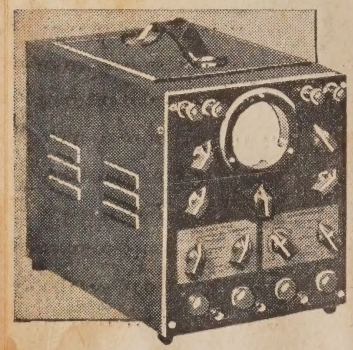
PALEC TEST EQUIPMENT AND METERS

MODEL VCT

COMPLETE VALVE AND CIRCUIT TESTER

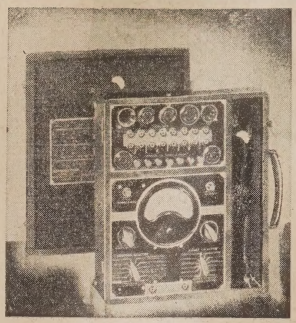
This well known model combines in one instrument rapid direct reading tests of all types of valves for both merit and leakage, together with complete circuit testing facilities, comprising:—Multiranges of DC, AC and OUTPUT VOLTS, MILLIAMPS, OHMS (from a tenth of an ohm to 10 megohms). It also provides INSULATION TESTS, the checking of PAPER CONDENSERS for open circuit and leakage, and the direct reading tests of ELECTROLYTIC CONDENSERS at working voltages.

The model VCT and the "PALEC" all wave Oscillator may be described as the serviceman's right and left hand, and with them every possible check can be made on a receiver—from the aerial coil right through to the speaker voice coil.



CATHODE RAY OSCILLOGRAPH MODEL "CJ"

Write for details of latest models employing special 902 type tube.



Palec Model "CM" Multi-tester, which measures D.C., A.C., and output volts, decibels, mills., ohms, and megohms capacity, inductance, impedance, and a.v.c. voltages. Price, £12/15/-, plus tax. Analyser Selector Unit, £2/15/- extra, plus tax.

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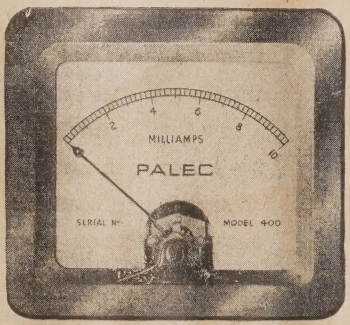
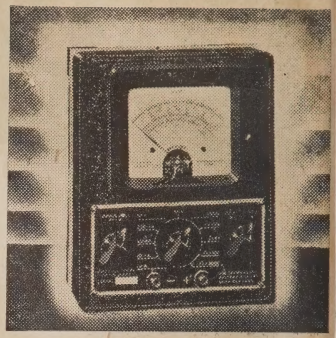


PALEC METERS

Above is illustrated the new model 400 type meter, particularly suitable for bench work and panel mounting.

Palec Meters are made in the popular 3in., 4in., and 5in. sizes. Flush mounted and projection types are available.



A NEW RELEASE

The workshop model M5 Multimeter featuring a solid metal case and fitted with our new large square type meter (scale length 3¼ inches).

RANGES: DC VOLTS 10-50-250-1000; MILLIAMPS, 1-10-50-250; OHMS, in three ranges from a quarter of an ohm to 1½ megohms. This reliable and handy instrument is both robust and compact (measuring 8in. x 6in. x 2½in.), and will be found ideal for general service or experimental work.

Price, complete with leads, £4/15/-, plus tax. Model MA5 as above with four additional ranges of AC volts, £6/17/-, plus tax.

Note: Provision is made on the model M5 for the inclusion of AC volts at any time.

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With the Editors

RADIO

The main radio feature this month is the R. and H. Portable Receiver. The introduction of the new 1.4 volt valves has entirely changed the popular conception of portable sets. For the first time, we are able to build a receiver which successfully avoids the great bug-bear of portables—the accumulator. Accumulators are, of course, very widely used for lighting filaments in home receivers, but they are a definite nuisance in portable receivers.

You can be quite confident in building this new set, which has accompanied our Technical Editor even into restaurants at lunch time. Sooner or later you are going to be swept up in this portable business. Even if you don't want to make the set at the moment, keep this issue by you. Before long you are going to need it!

AND

We would draw your attention to the article on the 5-metre converter in this issue. As you know, Ultra-high frequencies are used for television, and amateurs have a wonderful chance to do some grand experimental work down in these little known regions. We have heard rumors that our technical staff is playing about with apparatus to work on $2\frac{1}{2}$ metres and even lower, so watch out for some interesting articles to appear in the future issues. And remember this, the higher we go in frequency, the simpler is the apparatus required. RADIO AND HOBBIES intends that you shall be kept abreast of the times in this fascinating aspect of radio.

HOBBIES

This month, we present for the first time, full details of a real flying model aeroplane. It is the high-light of the Hobbies section. If you haven't experienced the thrill of seeing your own plane leave the ground, you've missed something! There should be no difficulty in duplicating the results of our Model Plane contributor.

In conclusion, we would like once more to express as our appreciation of your enthusiastic support for our paper.

This, our third issue, we know you will receive just as eagerly as those which preceded it. We are here, gentlemen, and here we mean to stay!

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A. G. HULL.

TECHNICAL
EDITOR:
JOHN MOYLE.

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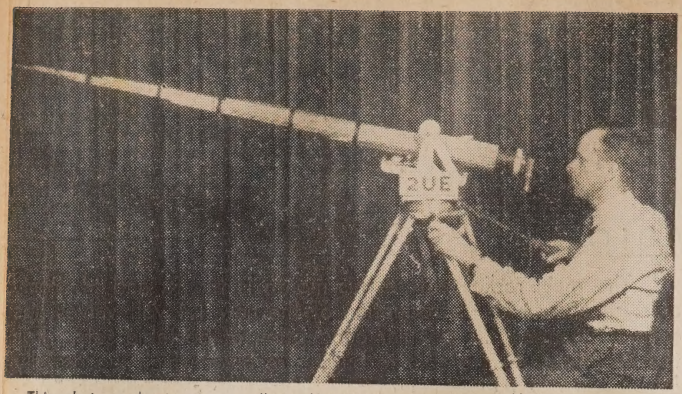


This photograph gives an excellent idea of the microphone and its assembly. With its aid, the operator may follow any performer round the stage, without picking up other sounds which cause confusion, and even mask the voice altogether.

The latest!

THE "MIKE" AND ITS APPLICATIONS

MACHINE-GUN mike has come to Australia.

No, this new arrival is not an American gangster, but the very latest in microphones.

It is owned by Station 2UE, and is the only one of its kind in Australia.

Resembling a machine-gun in appearance, it is mounted on a tripod, and can be pointed at anyone so as to broadcast his voice or the sound of the instrument he is playing to the almost total exclusion of all other sounds coming from other directions.

MANY USES

Station 2UE use it in their "Do You Want to be an Actor" broadcasts from the Assembly Hall every Friday night.

As each of the prospective actors on the stage speaks his piece the machine-gun mike is pointed at him, broadcasting his voice to the exclusion of the many other sounds which are inevitably heard in a crowded hall, such as coughing, muttering, rustling of programmes, and scraping of feet.

The machine-gun mike has another great advantage for stage work: It can be used while off the stage, and thus neither obstructs the audience's view nor impedes the movements of the performers.

It was also used during the last Anzac Day march, picking up the music of each of the many bands at which it was pointed, to the almost entire exclusion of crowd noises and the music of other bands.

And, what is more, each band could be picked up as soon as it came into sight round a corner three blocks away from the mike's situation at the corner of Elizabeth and Market streets.

Other uses to which the apparatus could be put are obvious. It could pick out the music of groups of instruments in a band, emphasise a soloist to the minimisation of the accompaniment, and pick out clearly any unexpected noises in a crowd, such as a sudden riot, disorder, shot, or car crash.

In the United States it is much used at football matches for picking up the numbers called out by the players and the "Ra, Ra, Ras" of the cheer-leaders.

One of the notable advantages of the mike is that it can be used at a much greater distance from the sound source than the ordinary mike can, because it can eliminate unwanted extraneous sounds.

HOW IT WORKS

The principle behind the thing is quite simple.

The machine-gun mike consists of a bundle of 55 duralumin tubes, varying in length from two inches to 5ft. 6in. The actual microphone, which can be of either the moving coil or "billiard ball" type, fits into a breach at the back of it. At the front of it the longest tube projects beyond all the others, the bundle being thickest at the back.

The sound waves from the sound source at which the apparatus is pointed enter the tubes directly, and so reach the actual microphone. Sound waves from sound sources behind or at the side of the apparatus, however, are almost entirely eliminated because of the acoustic resistance offered to them by the tubes.

That is why the machine-gun mike is known technically as an acoustic impedance element.

The farther to the side or back of the apparatus the source of the unwanted sound is, the more completely can that sound be eliminated.

If, for example, two men stand nine feet apart and nine feet from the microphone, the voice of one can be picked up to the complete exclusion of the voice of the other.

The machine-gun mike was recently brought to Australia from the United States by 2UE's chief engineer, Mr. Murray Stevenson.

It was built by the Western Electric Co. (U.S.A.), whose broadcasting activities are represented in Australia by Standard Telephones and Cables, and was released commercially only last year. It was developed by Bell Laboratories (U.S.A.).

The microphone being used in an actual outside broadcast. Note how the operator aims it just as one would a rifle.

MACHINE GUN MICROPHONE

Amazing new development

The combination of acoustic and electrical engineering is responsible for the development of this new microphone, which is being extensively used in U.S.A. where highly directional pick-up is required. The microphone described here was imported from America, and caused much interest when first used a month or two ago. This, however, is the first time we remember seeing a full description of it in an Australian magazine.

THE TECHNICAL SIDE

Here is Mr. Murray Stevenson's own technical description of the microphone. Mr. Stevenson is the chief engineer of station 2UE which employs it in regular service.

THE operation of the machine-gun microphone may be best explained by taking a specific example.

Let us assume that the microphone consists of only two tubes and that a sound, the wave-length of which is twice the length of the shorter tube, is arriving at an angle of 90 degrees to "normal" or "head on."

If the longer tube, "A," is twice the length of the shorter tube, "B," the pressure variations arriving at the mouths of the tubes will always be identical. That is, at one instant the air pressure will be normal, an instant later the pressure at each tube mouth will be maximum, later it will again be normal at both points, and still later the pressure will have dropped to sub-normal at the entrance to both tubes. This is so because the open ends of both tubes are exactly the same distance from the sound-source.

When the sound wave enters the different tubes it travels with the same velocity along each, but since the tubes are of different lengths the wave will travel down the short tube in less time than it takes to travel down the long one.

If the difference in length of the two tubes corresponds to half a wave-length, sound arriving at the microphone will be half the wave-length later when coming via the longer tube than that which travels through the shorter tube, with the result that there is a phase difference in the air chamber adjacent to the microphone of 180 degrees.

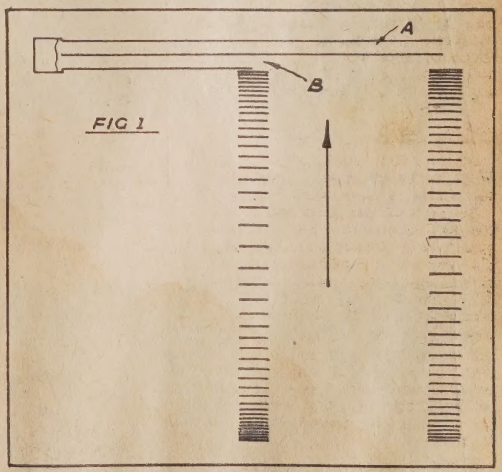
In other words, although pressure variations are identical and in phase at arrival at the open ends of the tubes, they are exactly opposite at the closed ends of the tubes, one reaching maximum pressure when the other has attained minimum pressure.

This results in a cancellation of high pressure, with the low pressure causing no net effect to be produced on the microphone's diaphragm.

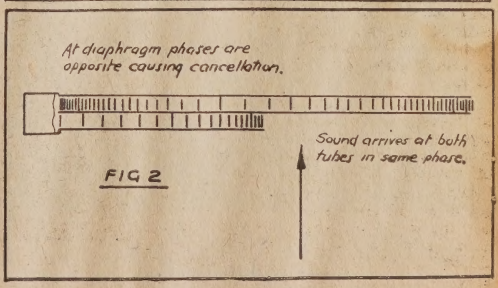
FIGURE 2 illustrates the pressure gradiant existing in two tubes, the lengths of which differ by half a wave-length of sound arriving from an angle of 90 degrees to normal.

This is the case where maximum discrimination against interfering sound is possible, since a cancellation of maximum pressure against minimum pressure is obtained.

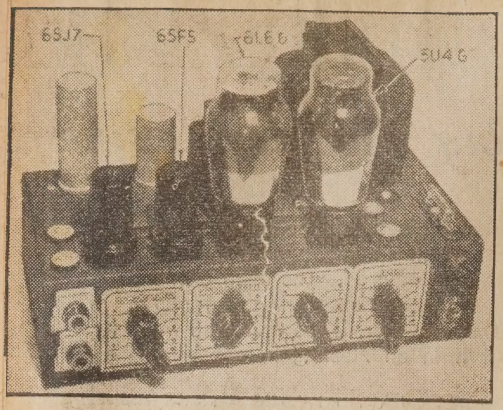
If sound arrives at less than an angle of 90 degrees from normal the wave front does not appear at the entrance to the various tubes in the same phase, since it arrives at each different tube at different times, and the effect of the cancellation becomes less marked, being zero when the sound source is directly in front of or "normal to" the microphone.



This diagram illustrates the various points mentioned in Mr. Stevenson's description which will be found on this page.



TECHNICAL



Picture of the completed amplifier.

5-WATT UNIVERSAL AMPLIFIER

THIS amplifier was primarily designed to fill the need for a good all-purpose low-power unit, which can be easily and economically constructed by any layman. Latest tube and circuit features are incorporated in this up-to-date, multi-use device. The complete amplifier weighs 15lb. (approx.); and measures 11 x 5½ x 7½ inches high.

PERFORMANCE CHARACTERISTICS

The amplifier incorporates such features as individual high and low frequency accentuation and attenuation, inverse feedback, and an anti-hum heater circuit for the pre-amplifier tube (6SJ7).

Aside from these unusual and highly valuable features, the amplifier follows a straightforward and economical design. It has a gain of 105 db. at the microphone input terminals and 60 db. at the phono input terminals. The feedback arrangement which loops the output transformer and output power tube provides for the production of 5 watts and 2 per cent. total harmonics.

The low-frequency control provides for a 10 db. boost or cut at 50 cycles. The high-frequency control, likewise, provides for a 10 db. boost or cut at 10,000 c. This type of frequency control enables the sound man to compensate for practically any input or output device. For recording it is highly desirable to attentuate the low-frequency end of the scale so as to obtain a constant amplitude below 250 cycles. During playback, however, it is desirable to boost these frequencies so as to reproduce a well-balanced programme. The high-frequency control will normally compensate for any deficiency in microphone or speaker frequency characteristic.

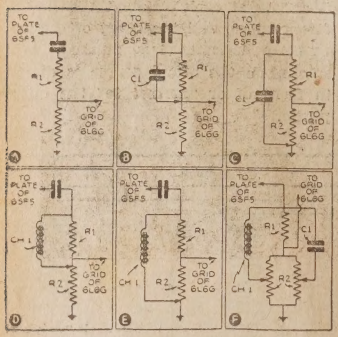


Fig. 2. Sequence of illustrations explaining the derivation of the audio frequency compensating network. See text for details.

FREQUENCY-COMPENSATING NETWORK

Figure 2 shows the derivation of this unusual type of frequency-compensation network which has already gained popularity in motion picture engineering circles. Figure 2A shows a normal drop in all frequencies encountered by inserting a series resistor between the plate of the 6SF5 and grid of the 6L6G.

Figure 2B shows how the high frequencies are raised by shunting R1 with the 0.001 mf. condenser, so that high-frequency accentuation is produced. This accentuation is, of course, gradual, and increases with frequency, inasmuch as the capacitative reactance of C1 decreases with an increase in frequency. The high-frequency droop characteristic is obtained when the moving arm (Fig. 2C) of the high-frequency control is turned towards ground. This condition only shunts the output of the preceding plate at high frequencies. This action is gradual. That is, greater attenuation is attained at higher frequencies. A normal setting is, of course, obtained midway between the "boost" and "cut" positions.

Similarly, the low frequencies are boosted when a properly-designed choke shunts the lossing resistor R1 (Fig. 2D). Inasmuch as the reactance of the choke Ch.1 decreases at lower frequencies, the effect of the losser resistor R1 is gradually shunted out, so that a low-frequency boost is obtained, accentuation being greater at the lower frequencies. Likewise, when the centre arm of the low-frequency control is turned towards ground, the low-frequency output of the preceding tube is shunted to ground, thereby producing an L.F. cut (Fig. 2E). A normal position is attained midway between the "droop" and "boost" positions.

In order to provide individual control of both the high and low frequencies, it is necessary to utilise separate controls in place of R2, as illustrated in Fig. 2F. This circuit diagram is now identical to the compensating network shown in the schematic diagram.—Radio Craft.

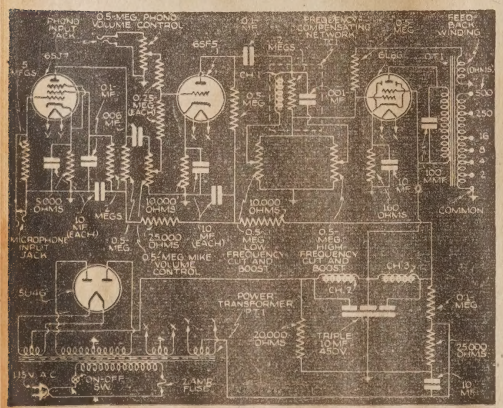


Fig. 1. Complete schematic diagram of the 5-w. high-fidelity versatile amplifier, featuring inverse feedback, and audio frequency spectrum control.

EDITOR'S WORLD REVIEW

Developments in other lands

METAL TAPE RECORDING

HERE are the details of a new recording machine, which uses a steel tape as the recording medium.

The idea of tape recording is not new, but it has not been used as much as film and disc. The machine shown here is the latest American development, and shows great promise.

The device should not be more expensive than the more popular methods, as it avoids the necessity for photo-cell equipment, does not suffer from needle wear, is practically free from breakages, is quick and permanent.

Background noise is almost non-existent, such noise as does exist being about 40 db. below the maximum signal level.

The tape is 120 mills. wide and 8 mills. thick, and permanence is much better than even the earlier types. There are in existence steel wire recordings dated 1903 which are still playable. After 17,000 playings it is claimed that the loss does not exceed 5 db. After 180,000 playings a further 4 db. is the only drop. The diagonal path of the flux contributes materially to the life, because of the extra length which results. The recording can be wiped out when required and the tape used again.

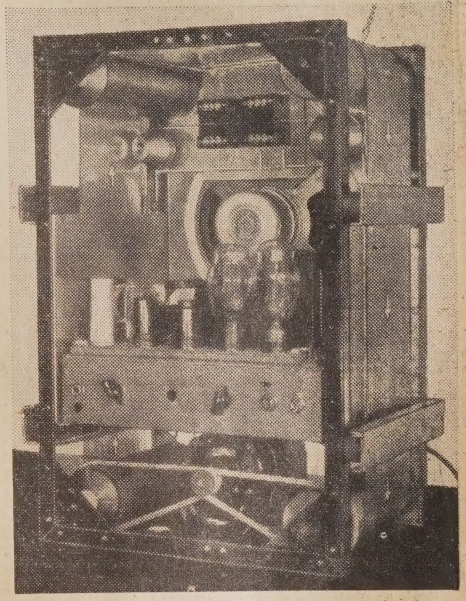
Change of speed is not as apparent in its result as with other methods, up to 17 per cent. being possible without material change in quality. Coiling the tape does not affect its permanence, and a temperature of 250 degrees C. is required before it will of itself affect the permanence of the recording.

The steel tape winds round four cylinders, one in each corner of a housing, 35 times, to make a rectangular coil. Then it cuts across the diagonal, inside the coil, and joins again to the beginning.

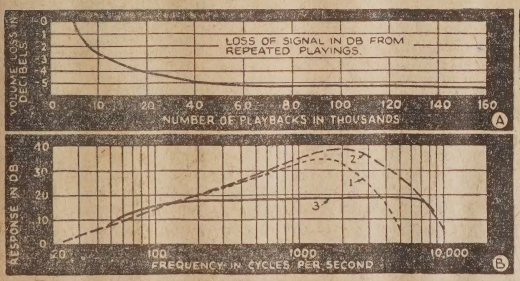
A small motor keeps the tape in continuous motion.

The endless helix has a recording length of about 360ft. for recordings of two minutes. Longer recordings than about 12 minutes use coils for storing the tape.

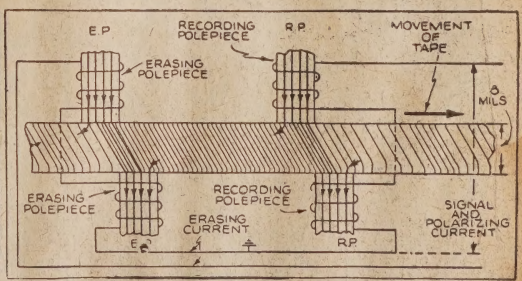
Coincident progress has been made in Europe. The British Broadcasting Corporation is now regularly using a highly perfected type of magnetic recorder and playback (in lieu of the sound-on-disc ("transcription") method universally employed in America as programme fill-ins) known as the Marconi-Stille recorder and reproducer [4, 5]; this device, with a frequency-reproducing range to about 8000 cycles (with **no** background noise), shows the advance that has been possible mainly through the use of the tube-type amplifier, and, last but not lease, **steel tape.** In Germany the "R.R.G. of Berlin" recently introduced the magnetophone (a non-inflammable film, 6.5 mm. wide, "coated with a thin layer of powdered metal") [6] for portable recording, due to it being completely unaffected by jolts in moving vehicles!



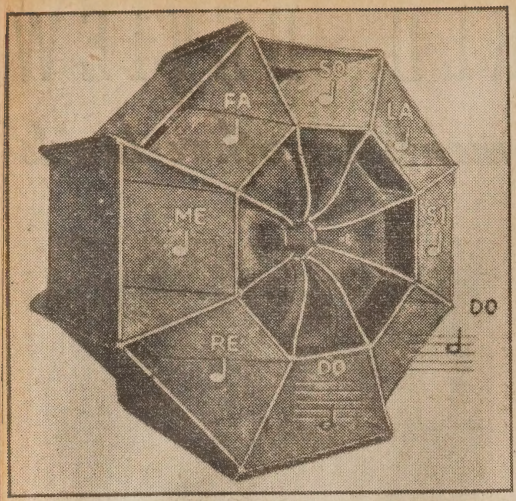
The recording machine described here.



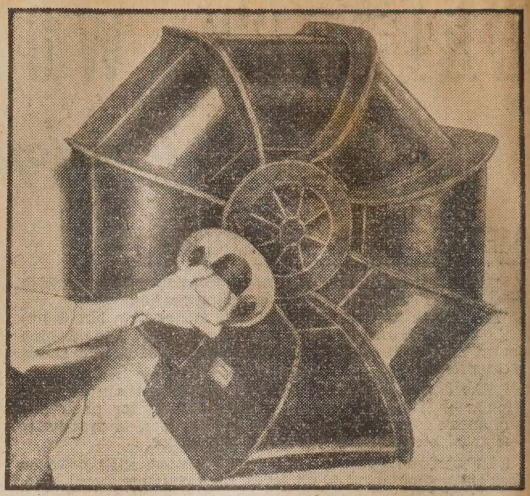
Graph A illustrates the loss of signal in db. from repeated playings of magnetic sound record on tungsten steel, 120 x 8 mils thick. Graph B shows frequency response, an attenuation network makes curve 3 possible.



Schematic detail of erasing and recording action. Maximum magnetic influence is obtained by virtue of the pole pieces touching the moving tape; by applying D.C. to polarise the winding and then modulating this D.C. with the signal; and by magnetising the longest path through the tape.



This gives an idea of how the eight horns are arranged to cover the full musical scale, according to their shape and length.



This is where the speaker is mounted at the back of the horn assembly.

MULTIPLE-COLUMN BAFFLE

WE know that a tuned air column will reinforce a basic frequency and all overtones of the basic frequency. The unique construction of the Octave Resonance, multiple air-column baffle, enables a full octave of resonant air-columns to be loaded directly onto the loudspeaker cone. This provides perfect loading or damping at all frequencies.

Not only through perfect loading is the original purpose of the baffle realised but in addition thereto an increased efficiency of the speaker unit itself is obtained. In laboratory tests the efficiency percentages of some loudspeakers were increased as much as 30 per cent. through the use of this particular baffle. In itself this feature is to be by no means overlooked.

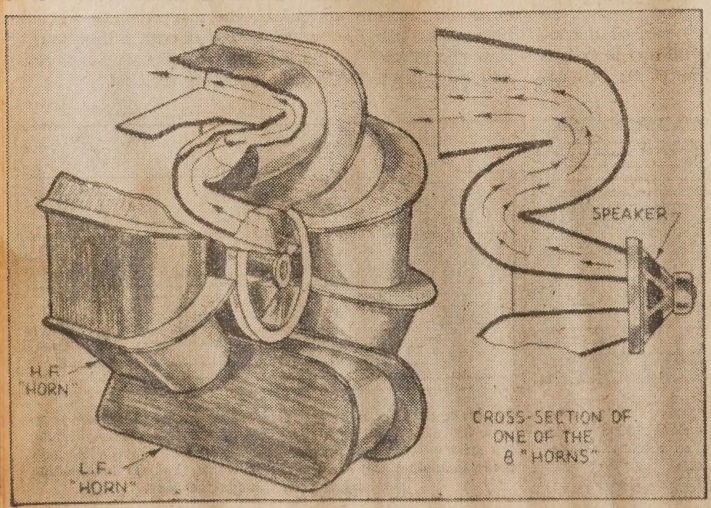
Fundamentally, the unit is based entirely on a principle which for many years has been accepted by the musical world, but has hitherto not been applied to loudspeaker performance. The Octave Resonance Baffle consists of a group of 8 chambers or pipes originating at the cone of the loudspeaker; each pipe is arranged to obtain 1-8 of the sound pressure from the excited cone. These pipes are so constructed as to be tuned to 8 fundamental frequencies on which all musical composition is based.

Being tuned (in a sense) to fundamental musical frequencies this new development in loudspeaker baffle tends to prolong, only to a desired degree, the lower tones of orchestral accompaniment. In this matter the full rich tones and overtones of the bass viol, tuba, etc., are fully developed in each's proper relation to other instruments.

Not only are the low-frequency instruments brought out in reproduction but also the high-frequency instruments are "helped." This is due to the fact that harmonically the unit extends the range to 9 times the fundamental range of the piano, which is in the present-day world the fundamental instrument in any orchestral group. The human voice is reproduced accurately, including all overtones. The human voice has properties similar to a musical instrument, and faithful reproduction is obtained in the same manner as that required to reproduce a musical instrument.

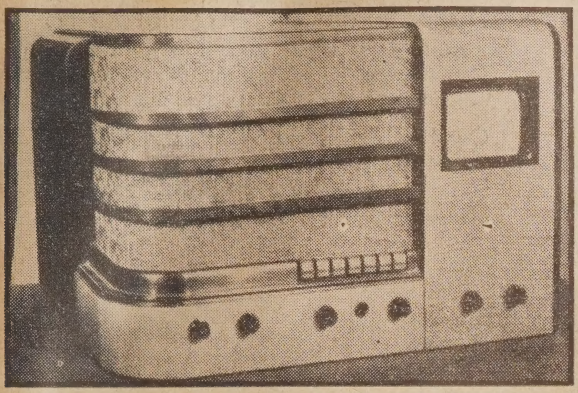
Transverse vibrations within the tone chambers of the baffle do not interfere with each other during a period at which two entirely different but related frequencies are being reproduced. This is attributed to the ability of each pipe to faithfully reproduce as many as 20 different musical tones so long as these tones are related to the fundamental frequency at which the pipe is tuned or are harmonics of that basic frequency.

—Radio Craft.



This cross-section view illustrates the zig-tag method of construction in the octave-resonance baffle. The design and construction, as can be imagined, is not an easy matter, and has called for considerable thought and no doubt experiment. It would be a very expensive thing to construct, as the wood alone together with the labor, would represent quite a sum. For that reason, the device as shown would have limited application, although the idea might be adapted to smaller units for more general use.

TELEVISION ADVANCE IN U.S.A.

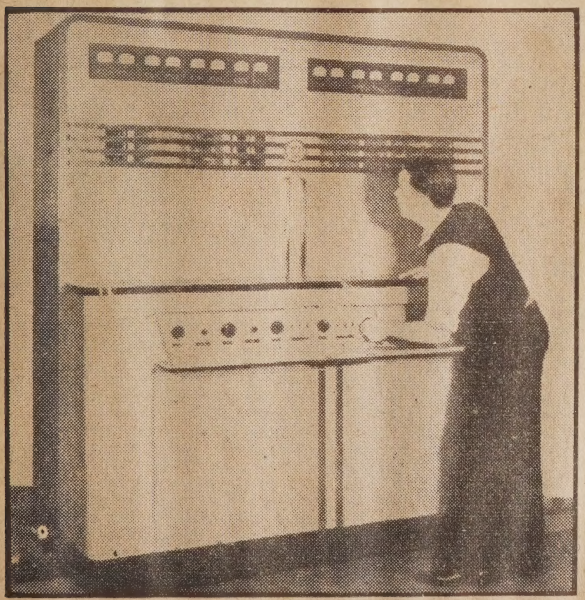


TELEVISION is making great strides in America, and the new services are destined to open a new chapter in the broadcasting history of the U.S.A. For this reason, these pictures will be of interest, as illustrating what is being done on the other side.

The receiver pictured above is made by the General Electric Co., and illustrates the tendency to design a 5-inch tube chassis to the lowest possible cost.

The 5-inch chassis has no R.F. stage, and uses a single-valve converter. The bandwidth of the amplifier is purposely limited to 2 mc., which corresponds to a definition of 200 lines, the practical limit imposed by the size of the spot relative to the picture size, on a 5-inch picture valve. Four I.F. stages are needed to gain a modulated picture, modulate the valve fully with 400 microvolts input.

Below: A 1kw R.C.A. transmitter which sells, without accessories, for about £5000.



Also shown here is a 1000 watt transmitter made by the R.C.A. of America, which, without accessories, sells for about £5000. The accessories, of course, would very greatly add to this sum.

Transmitters are available which use 10 valves in the sound section and transmitter section, although the bigger jobs will run up to, and over, 25 valves, exclusive of about 35 rectifiers.

The transmitter illustrated uses ten 813 valves in parallel for the modulator stage.

The third picture shows the appearance of the CBS aerial and transmitter house on the top of the Chrysler building in New York.

The aerial of the C.B.S. on the top of the Chrysler building in New York.

The MIRROR

Everyone, from my lady tittivating in her boudoir, to the scientist who studies the stars, relies on the simple mirror for results. The science of reflection is something which has puzzled many people many times.

Our Popular Science writer here tells you something about mirrors, and we wager you didn't know all of it before. Read this article, and treat your humble mirror with respect.

By CALVIN WALTERS

A mirror is perhaps the most absurd of all objects. At least, that is what I have been led to believe from the remarks made from time to time by people who have seen me looking at myself in one. "Don't know how the mirror stands it"; "Look out you don't crack the mirror," and such like kind remarks. Apparently there is some truth in the proverb that we don't see ourselves as others see us.

However, what a funny world it would be without mirrors. Imagine going along to the dentist and having him prod around among the old molars with his chisel, or whatever he calls it, until it falls into a cavity. Nowadays all he has to do is to bring out the little mirror on a stick, force it into your throat, and say, "Oh, yes, it is the fifth bicuspid," or something or other. Ever so much more refined, and in keeping with the money you are going to owe him.

Then, of course, there is the doctor. When you had a pain in the tum in the old days all he had to do was to give you a punch in the solar plexus, tell you it was cancer, get out his knives and things, chop around, and say, 50 guineas, please. Now, of course, he gets his stomachscope, makes you swallow a rubber tube with a mirror inside it, has a look at your internals, sends you to a pathologist, who, in turn, sends you to a radiographer, who takes a picture of your midriff. The picture is sent back to the first doctor, who looks at it, tells you that you have indigestion, and sends you to a chemist with a prescription for some Sodii Bicarb and Aqua, or, in other words, baking soda and water, to be taken after every meal.

WITHOUT MIRRORS

Of course, all this means that the little mirrors save a lot of probing in the dark. And what would the ladies do without a mirror? You can answer that one yourself. Astronomers would be deprived of their eternal searching of the heavens for new stars and comets, etc. They wouldn't know—simply wouldn't know, mind you—whether Mars was 60 millions of miles away from us or 60 million miles 6 inches. There would be no lighthouses without mirrors, and no searchlights; the moving-picture machines would be practically useless without reflectors. The microscope would be of little value, which, in turn, would limit our knowledge of bacteria, and the day of high efficiency in machines would not be with us, because it is only through microscopic and spectroscopic examination of metals that alloys have been developed which are able to stand the terrific strain imposed on them by present-day standards of speed and weight.

ANCIENT MIRRORS

To most of us a mirror is—well, just a piece of silvered glass. Of course, mirrors were not always made of glass. Centuries ago reflecting surfaces were produced on metal. Then somebody found a way of depositing mercury on the surface of glass, and the business has never looked back, so to speak. The present-day mirror is made with a deposit of pure silver. Perfectly clean glass is laid on a heated and blanketed table, and a dilute solution of nitrate of silver, ammonia, and tartaric acid poured on to it. The silver is deposited on the glass from the solution, and the glass is dried and painted for protection of the very thin silver coating. Silvered glass gives about 25 per cent. more light than the old-fashioned mercury-coated mirrors.

OTHER PROPERTIES

Now, there are a few properties of mirrors which, although perhaps commonly known, are not as commonly explained, if I am permitted to put it that way. For instance, you have probably noticed that in a comparatively small mirror hanging on the lounge-room wall you can see much more than is actually in front of the mirror. If you stand close to one end of it and look into the other end, you can see reflections of objects that are not in front of the mirror at all. The reason for this is explained in Fig. 1.

Any light striking the mirror at a certain angle will be reflected from the mirror at the same angle. Referring to Fig. 1, we have a mirror, a, B, c, any object A, such as a chair, and your

eye C. Now, light reflected from the object A will strike the mirror at, say, B, making the angle of incidence, as it is called, A B a. Being reflected from the mirror at the same angle, it is necessary that you stand in such a position that a line drawn from your eye to the mirror will make the angle C B c equal to A B a. You will then see the object A in the mirror, notwithstanding the fact that it is not directly in front of the mirror itself. This does not mean that you have to borrow a surveyors' theodolite and work the angle out before you can know in what position to stand. All you do is to walk towards the mirror until you see the object, and the angles automatically arrange themselves. Nature does it for us.

That is one thing I like about nature. It does things for us automatically, and saves us a vast amount of thinking. The above property of a mirror is worth while remembering, for you can't always guarantee you are not being seen when you make gestures of derision behind anyone's back and there is a mirror on the wall.

☆

See Article for Clue to This Diagram

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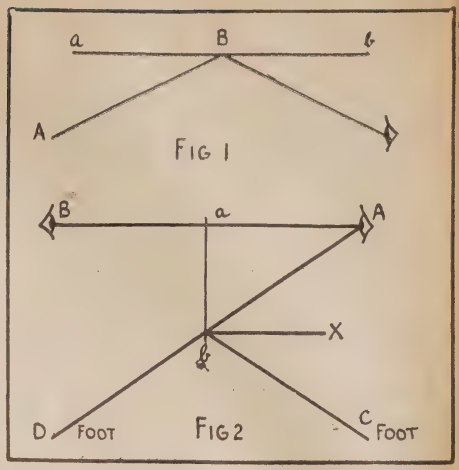


SEE DIAGRAM

Another property of mirrors is worth mentioning. In order to see a full-length image of yourself in a mirror it is necessary to have one only half your height. If you will kindly look at Figure 2 you will notice that A represents the spectator, and ab is the mirror. Now, an image always appears in a mirror at the same distance behind it as the object is before it. The ray from your eye will go from A to a and back to your eye in a straight line. But the ray from your foot, C, in order to be seen at the eye, goes from Cb and reflected along bA. So that, if bx is a line perpendicular to the glass, the incident angle will be Cbx, and the reflected angle will be Abx. And, therefore, the foot will appear behind the glass at D along the line AbD, and that part of the glass intercepted by the line AB and AD is exactly equal to half AC.

INTERESTING PROPERTY

I mentioned above that an image in a mirror always appears at the same distance behind a mirror as the object is before it. This property is often used by opticians if the room in which your eyes are to be tested is rather small. He has a card, as you know, written in a foreign language of some sort. It goes something like this: QWERTYUIOP ASDFGHJKL, and so on. You are supposed to be able to translate this, and if you can't you need specs. If, now, the room is so small that the optician can't get the card far enough away to make sure you can't read it, he digs out another one written backwards, sits you against the wall facing a large mirror, and hangs the card above your head. You then strain your eyes trying to read the card in the mirror hanging on the opposite wall. If the room is, say, 8 feet wide, the card appears 16 feet away, because it appears as far at the back of the mirror as it is befor it, and incidentally the optician get a larger room without paying any mor rent.

A rather intriguing experiment ca be performed by hanging a mirror o one wall of a room and another exactl parallel to it on the opposite wall. I then, you stand a little to one side an look in one mirror, you will see a endless line of mirrors, each reflectin that part of the room in front of it. often think that barbers' shops ar fitted this way sometimes to make i appear that there are a tremendou number of chairs, and therefore giv you the impression that you have nc long to wait for your turn.

CONCAVE MIRRORS

Mirrors, of course, are made other wise than flat. There are concav mirrors. These magnify, and are th type used in the huge telescopes i observatories. Mirrors of this kind ar made to almost unbelievable standard of accuracy. There is a mirror jus about completed for the Mt. Paloma Observatory, in California. This weigh 20 tons, and is seventeen feet i diameter. In combination with specia lenses, it is claimed that astronomer will be able to see the light from star six textillion miles away. The wors stickybeaks imaginable. They must b sorry the earth is round. If it was fla we could see them peering at everythin we did. There would be no privacy a all.

The mirror referred to above too months to cool under control. Durin the grinding and polishing the tem perature was maintained at a precis level. Even the heat from the work man's body tended to affect the material In the grinding process the standar of measurement was the Micron 39/1,000,000 of an inch, and the len was rubbed down to one-quarter of a wave-length of Sodium light, o 6/10,000,000 of an inch.

An elementary

COURSE IN RADIO

for beginners

Being a very elementary course of Radio study for those who wish to know "what makes the wheels go round."

By L. B. GRAHAM, Principal of the Australian Radio College, Pty.,

FUNDAMENTALS OF TRANSMISSION

WE have covered the principles of electrical current flow, the various types of opposition that electrical energy has to contend with in radio, and in addition, the action of probably the most important circuit in both reception and transmission, the oscillatory circuit.

Before applying these basic fundamentals to reception it is necessary to know just what we are going to receive, and how it is going to be introduced into the receiver.

The whole idea behind radio is to convey sound of some description from one place to another. An understanding of what sound is, and how we are going to convert it into a form which can be used for transmission, is necessary to obtain a full appreciation of the circuits used in transmitters and receivers.

SOUNDS

In thinking of sounds we classify them roughly as noises and pleasant sounds. Noises are those sounds which grate on the ear. They do not follow any definite law and have no rhythm or musical quality. Speech and music, on the other hand, are pleasant, because they possess both musical qualities and rhythm. Both types of sound are used in transmission, mostly of course speech and music, but noises are frequently used to create a background for plays, etc.

Sound is a disturbance in the air or a variation of air pressure, which affects the diaphragm or ear-drum of the ear, creating movement of this membrane, and this in turn creates stimulation of the hair-like nerves of the inner ear and the brain recognises these stimulations as sound.

Sound has three distinct qualities which a musician would term pitch, timbre or quality and intensity or loudness. In radio we substitute the terms, frequency, harmonic content and amplitude or strength respectively.

The frequency of a sound is the number of complete air pressure variations which occur in one second, one complete air pressure variation would be represented as shown in Fig. 1A, where the movement of some object in the air has created, firstly, a compression of the molecules of air, secondly a rarefaction of these same molecules, and then returned to its normal position. This may be represented as a simple wave as shown at 1B.

The ear can respond to air pressure variations which occur between approximately 15 and 20,000 times in one second. These limits vary with every individual person, depending on the responsiveness of the ear.

Musical instruments produce sounds varying in fundamental frequency between 32 and 4608 complete air pressure variations or cycles per second. A frequency of 32 cycles would be heard as a very low pitched bass sound, that of 4608 would sound as a very high pitched or treble note.

HARMONICS

The second quality of sound, the harmonic content, is that part which enables us to distinguish between various instruments all playing the one note. A violin may play the same note as a piano, they both produce the same fundamental frequency, but do not produce the same sound. One has a different quality to the other, this difference lies mainly in the harmonics produced by the instruments. These harmonics are rather difficult to understand as you need to visualise one musical note being composed of several different frequencies. If the string of an instrument is plucked it may vibrate as a whole and also in parts, the vibration of the whole string gives the fundamental frequency, and the vibration of the parts gives the har-

FIG 1A

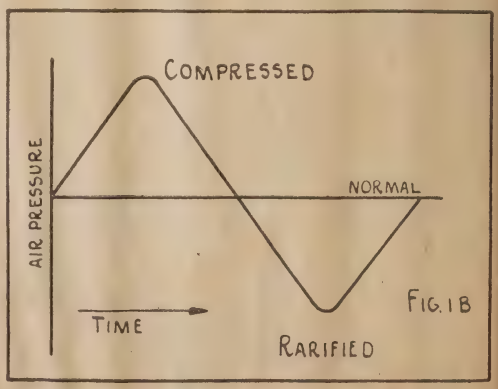


FIG. 1B

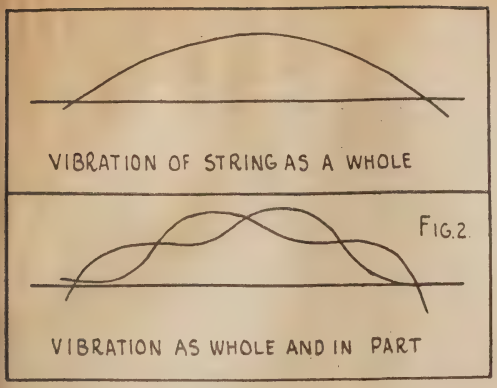


FIG.2.

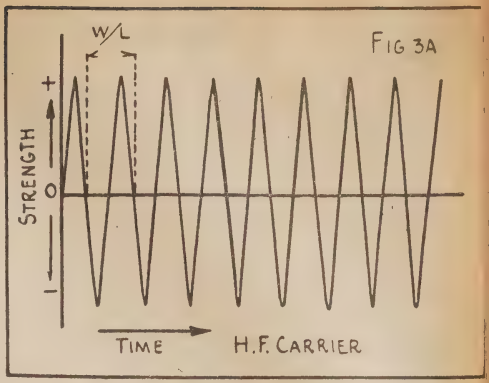


FIG 3A

monics. This is illustrated in Fig. 2. These harmonics are direct multiples of the fundamental, and extend to and past the highest audible limit. For example, a fundamental of 4000 cycles may also produce harmonics of 8000, 12,000, 16,000, and 20,000 cycles.

The third quality, that of amplitude or loudness, explains itself. It is of interest, however, that the average ear can just discern sound pressure variations of .000,000,015lb. per square inch, while changes of .015lb. per square inch are so loud that it causes a sense of pain. The lowest recognisable sound level is termed the threshold of audibility, and the upper limit is termed the threshold of feeling.

This study of sound gives us an insight into just what we require our radio to reproduce, and with later articles will let you see more clearly the reason behind the various circuits used in radio design.

TRANSMISSION

Sound as a variation of air pressure cannot be transmitted over very great distance, and has to be changed to electrical impulses and added to a radio carrier wave before it can be transmitted into space to be picked up by a radio receiver. The instrument which accomplishes the change to electrical impulses is known as a microphone. There are a number of different types of microphones; it is not, however, intended to discuss them in this article. It is sufficient for the time being to know that variations of air pressure create movement of the microphone's diaphragm and this in turn, by a variety of means, produces changing electrical impulses, which will then be a replica of the original sound wave.

The carrier wave is a wave of high frequency generated by means of a tube connected as an oscillator. In its most simple form this consists of an oscillatory circuit, as explained in the last issue, in conjunction with a valve which is connected to it in such a way that energy is being added to the oscillatory circuit in sufficient quantities to make up for the loss due to the circuit's resistance. As will be explained later, the frequency of the oscillations will be determined by the electrical size of the condenser and coil in the circuit.

When transmitting on the broadcast band the frequency at which these oscillations occur may be anywhere between 550,000 cycles per second and 1,500,000 cycles per second. These frequencies are naturally far too high to be audible, and are only used to convey the sound frequencies from the transmitter to the receiver. In diagramatic form a carrier wave would be represented as in Fig. 3A, and an audio frequency as in Fig. 3B.

You have probably noticed that a station's carrier wave may be designated in both frequency in kilocycles (one kilocycle being equal to 1000 cycles), and wave length in metres. The wave length is the distance one wave travels before the next one comes along, or, in other words, the distance in metres between any part of one wave and a similar part of the next.

It may be seen from Figure 3 that the wave length will depend on the frequency. The greater the number of alternations occurring in a given time the shorter will be the wave length. Electrical energy travels at the rate of 186,000 miles or 299,820,000 metres per second. If this latter number is divided by either the frequency in cycles or the wave length in metres, the result will be the wave length in metres, or the frequency in cycles, respectively. The number 300,000,000 is close enough for ordinary calculations.

MODULATION

Having obtained the audio frequency and the carrier wave, it is now necessary to add the two together before the combined result can be transmitted out into space. The process of combining the two is called modulation.

The two frequencies are combined in such a way that the audio frequency creates a variation of strength or amplitude of the high frequency carrier wave. If the frequencies represented in Figs. 3A and 3B are combined, the result would be as illustrated in Fig. 4.

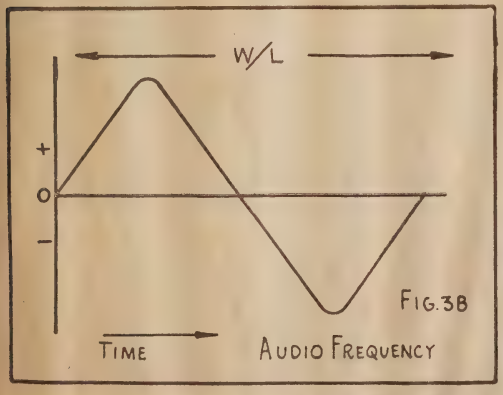
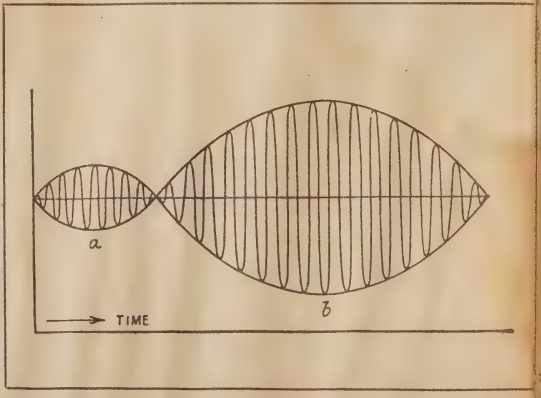


FIG.3B



About

SELECTIVITY

and what it means

A knowledge of the factors which determine the selectivity of a receiver is a most important asset to any set builder. This article is written by a man who is recognised as an authority on receiver design, presents a preliminary outline of the manner in which the engineer goes about analysing the coils he has made. It will be followed with a further article next month, explaining how selectivity curves should be interpreted, and their effect on performance and tone.

By

E. M. FANKER

(Chief Engineer of Thom & Smith Pty. Ltd.)

SELECTIVITY may be defined as the ability of a radio receiver to differentiate between a desired signal and disturbances originating on other equencies.

Were it not for this property, all ansmission of similar signal strength ould be heard together, and the numr of stations able to operate would only a minute fraction of those in e to-day.

Fortunately, radio communication is fected by radiation of electro-magtic energy produced by alternating rrent whose frequencies may lie within e range of 10,000 to 200,000,000 cycles r second, and by employing means to ne the transmitter and receiver to renance with each other, it is possible carry on a vast number of communiations simultaneously without interrence by employing different frequenes for each one.

ELECTRICAL CONSTANTS

All electrical circuits contain three ctors: Inductance, capacity, and resstance, and the combination of these overns the particular frequency to hich the circuit is most responsive.

The first two factors are opposite in ffect, and for any combination of these here is a certain frequency at which they cancel each other, and leave only pure resistance in circuit.

The lower the value of resistance remaining, the sharper will be the response at resonance, and the greater the discrimination to other frequencies. By varying the value of capacity and/or inductance, it is possible to tune the circuit to any desired frequency, while the resistance is governed by the electrical losses in the circuit components.

CASCADED CIRCUITS

The use of a number of circuits in cascade tuned to the same frequency greatly increases the selectivity, and in the same manner as reducing the resistance losses. In practice, it is usually found the simplest method, as it becomes impractical to reduce the residual resistance beyond a certain value.

Losses due to resistance also increase rapidly with increasing frequencies, and for this reason it is far more difficult to obtain good selectivity at high frequencies than low frequencies.

The first receivers used only one tuned circuit, but with increasing number of stations it became necessary to add more circuits, which in turn introduced complications in tuning.

This resulted in attempts to gang the tuning controls, and this was fairly successful up to 4 or 5 circuits, but beyond this, production difficulties caused receiver manufacturers to look around for a simpler method. The superheterodyne method of reception had long been known as a means of obtaining high selectivity. The intermediate frequency amplifier having as many as six tuned circuits, which once adjusted required no further tuning, and the knowledge gained in ganging the tuning controls of the tuned radio frequency receivers, resulted in the development of a simple single control receiver which is almost universally used to-day.

Up to this time the selectivity problem had consisted of separating stations whose frequencies were greatly separated, and the only unusual type of interference to be found was that known as "cross modulation."

This form of interference took the form of a background of the transmission of the undesired station, which only

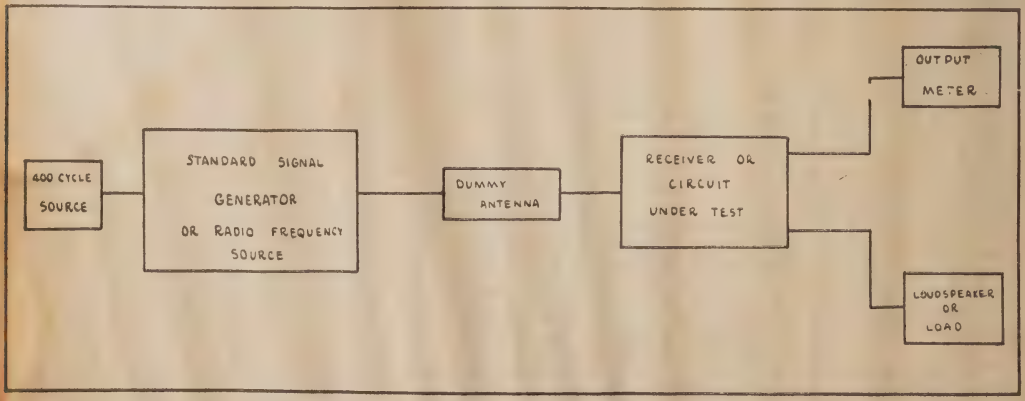


FIGURE ONE

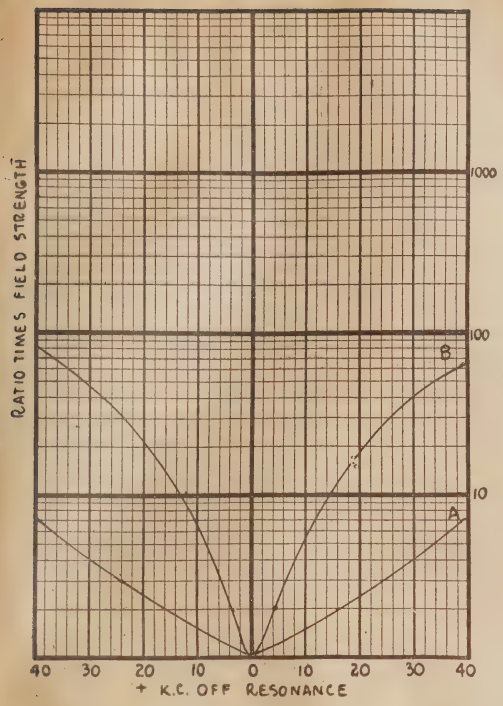


FIGURE TWO

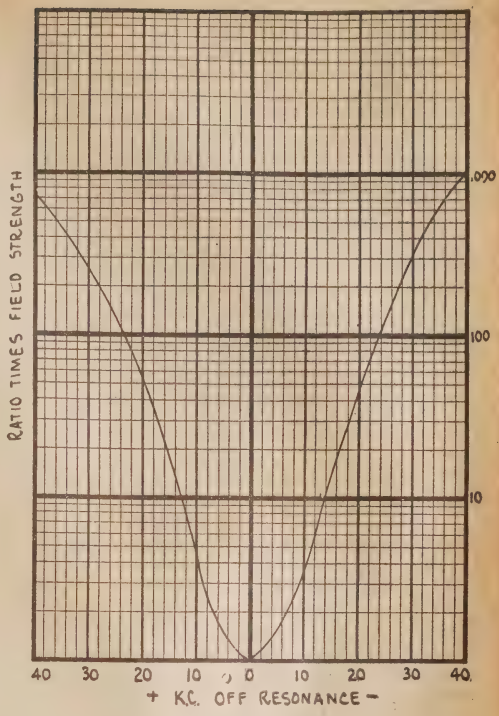


FIGURE THREE

appeared when the receiver was tuned in to another carrier. The cause of this interference was found to be overloading of the preliminary valves in the receiver, and brought about the development of the variable MU type of valve, the characteristics of which reduced this type of interference to a minimum.

THE SUPERHETERODYNE

With the advent of the superheterodyne receiver, however, other types of interference became prominent which were not previously noted, these taking the form of repeat spots of a strong local station, at other frequencies, together with whistles which occurred at various points on the receiver dial. The causes of these types of interference will be discussed later, together with the methods adopted for their elimination.

The ability of a radio receiver to select the desired transmission and discriminate against others, may be measured by means of laboratory test equipment, which reproduces in effect the conditions the receiver is required to work under in actual operation. The apparatus employed in the testing of radio receivers operating in the frequency range from 540 to 23,000 kilocycles has become fairly well standardised. The instruments are used in test procedures under conditions which are intended to simulate as accurately as possible, the operating conditions in actual service.

THE TEST SET-UP

The arrangement of the testing apparatus for many of the performance tests is shown in figure 1. The connections of the standard signal generator for two signal tests are described separately. The principal measuring instrument is the standard signal generator which is the source of controlled radio frequency tests signals. It consists of a radio frequency oscillator of the vacuum tube type, which is adjustable over the entire radio frequency spectrum in which the receiver unde test is expected to operate. The radi frequency oscillator is provided wit means to modulate it to any desire degree at audio frequency. The usua commercial instruments contain a fixe frequency 400 cycle modulating systen which is standard for many of the per formance tests. Connections are als usually provided for external modula tion adjustable over the audio frequenc spectrum from within about 30 to 10,00 cycles.

Within the signal generator the out put of the modulated oscillator is at tenuated by an adjustable and calibrate electrical network designed to vary th output voltage level of the standar signal generator over a wide rang Since the output voltage of the stan dard signal generator is usually too lo to be read directly, the radio frequenc voltage is measured at the input to th attenuator, where the voltage and powe levels are relatively high. A vacuu tube volt meter or a thermo coupl meter is generally used for this purpos Resistive, capacitative, and inductiv types of attenuators are in general use

The relative type has a distinct ad vantage in that it can be so designe that its impedance is substantially in dependent of the frequency at which is operated, and thus is the type mos commonly used.

The radio receiver under test i coupled to the output terminals of th standard signal generator through standard dummy antenna designed t provide impedances closely approxima

In our July issue, Mr. Fanker continues his discourse on selectivity and its effect on receiver performance. In it, he will clear up many doubtful points which exist in many minds about the general conception of selectivity. Don't miss it, if you have appreciated this preliminary survey. It will help you to get the most from your receiver.

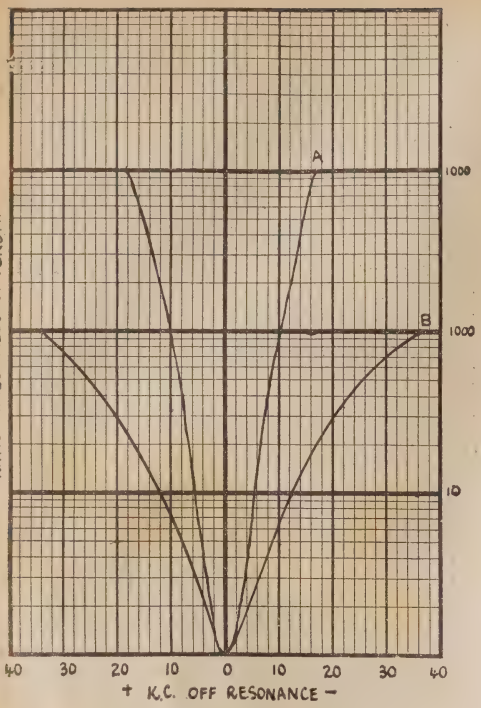


FIGURE FOUR

ng the average of the impedances of ntennas which have been found in tual use.

UDIO OUTPUT

The audio frequency electrical output the receiver under test is measured in rms of the power delivered to a stanrd dummy load. Power may be indited directly by a milliwatt meter or lculated from the voltage or current the load.

In order to make tests of selectivity d to determine whether the performce of the receiver will be satisfactory nen operating in the field of strong ations an output voltage of at least o volts is required. The standard nal generator is usually adjustable om output of from approximately 0.5 icrovolts to at least 100,000 microvolts. d the standard signal generator, if t directly calibrated, has calibration arts which show the frequency range against the dial setting.

For certain tests of radio receivers two dio frequency input signals are reired simultaneously, and consequently o standard signal generators are cessary. There are various methods connecting these to the receivers, but e procedure in brief consists of feedg a signal from one generator at the sired test frequency and then varying e other generator over a wide range frequencies and measuring any reonse that may come from it.

UMMY ANTENNA

The input voltage from the signal nerator is fed to the radio receiver through the dummy antenna, which usually has an impedance in the vicinity of 400 ohms, and the output from the receiver by means of a suitable meter.

Measurements of selectivity are made at more than one test frequency, and these are usually in the broadcast band, 1400 kc, 100 kc, and 600 kc. The radio receiver is tuned in succession to each test frequency, and the output of the signal generator is adjusted to give a reading of 50 milliwatts in the output meter. The signal generator is then detuned each side of resonance, the radio frequency input voltage which results in normal test output is observed, and its ratio to the original test input is computed.

Observations are usually made until the ratio exceeds 10,000 times the original signal input or until the observed input voltage exceeds 1 volt. Selectivity measurements are usually made in the broadcast frequency spectrum or at the intermediate frequency of the receiver. Approximate selectivity at other frequencies may usually be deduced from the results of measurements made at these frequencies. If the receiver is provided with variable selectivity, measurements are made at all positions of the selectivity control. When making graph of the selectivity of a radio receiver, the ordinates of the graph may be divided into decibles or numerical ratios. On the graph shown these are numerical. To convert the graph to decibles, an easy method of computation is to take the line marked "twice input" as 6 decibles, "ten times input" as 20 decibles, "one hundred times input" as 40 decibles, and so on.

OTHER FACTORS

In receivers embodying manual volume control selectivity may be affected by this control, and it is necessary to take curves at various sittings of the volume control. Receivers employing automatic selectivity control require complicated test procedure, and it is necessary to apply varying potentials to the control circuits, representing different operating characteristics. This test procedure has considerable value in determining the performance of a receiver as to its selectivity against stations operating in nearby channels, but does not give conclusive information as to the interference output from other signals simultaneously present with the desired signal.

The effect of interference on the receiver characteristics may be outlined by two signal tests or by feeding input from the signal generator to the receiver at frequencies vastly different to that to which it is tuned. With the radio receivers tuned to each of the test frequencies, the signal generator should be continuously varied over a wide frequency range to discover if the receiver is simultaneously resonant at frequencies other than the test frequencies.

SPURIOUS FREQUENCIES

These other resonant frequencies are called spurious response frequencies, and are most often found in superheterodyne receivers. Each spurious response frequency is noted and the spurious sensitivity test input is measured as in a sensitivity test (provided that it is smaller than one volt). Its ratio to the desired signal sensitivity test input may be computed, and is called the spurious response ratio. This ratio may be expressed in decibles or as a numerical ratio of voltage.

This test is properly classified as the selectivity or interference test, although its procedure is that of a sensitivity test. Care should be taken to see that the harmonic output of the signal generator is attenuated sufficiently not to affect the observations of the spurious response of the receiver.

The superheterodyne receiver responds to two frequencies whose difference from the local oscillator frequency is equal to the intermediate frequency. One of these, usually the lower, is the desired signal frequency, and the other is called the image frequency. This is a special case of spurious frequency response and is tested as such. Its observed characteristics are referred to as image sensitivity and image ratio. Another special case of spurious response frequency in a superheterodyne receiver is that due to the sensitivity to an intermediate frequency signal input through the aerial.

SELECTIVITY CURVES

The best procedure in this case is to feed a signal at the intermediate frequency to the aerial terminal of the receiver and measure the output reading. The selectivity of a simple receiver em-

ploying one tuned circuit is shown in figure 2A, while the improvement effected by introducing another tuned circuit is shown in figure 2B. These curves may be compared with those of figure 4, which show the selectivity of a modern type of superheterodyne receiver and which are the minimum consistent with satisfactory separation of the large number of stations operating to-day.

The spurious responses which appear in the superheterodyne receiver in the form of repeat spots or whistles at various points of the dial may be attributed directly to insufficient selectivity ahead of the first detector valve and the degree to which the receiver responds to these spurious signals may be taken as an indication of the selectivity at this point of the circuit. Early superheterodyne receivers utilised a comparatively low intermediate frequency, varying from 30 to 150 kilocycles. These receivers were naturally subject to considerable trouble from image frequency response, due to the comparatively small difference between the interfering and the desired signal and resulted in the use of higher intermediate frequencies to reduce this trouble, the most common I.F. in use to-day being in the vicinity of 460 kilocycles per second. The use of the higher intermediate frequency also helped to reduce the number of repeats and whistles caused by harmonics of the intermediate frequency falling within the tuning range of the receiver, although due to their proximity to the fundamental their amplitude and interference is consequently greater.

Curves shown in figure 3 are interesting compared with those shown in figure 4. Figure 3 shows selectivity of an early superheterodyne having 465 kilocycle intermediate frequency, while that of figure 4 shows the selectivity of a modern type receiver.

The curve shown at A is taken from the grid of the frequency converter valve, while that of B is taken from the grid of the intermediate frequency valve, and the improvement in selectivity by the use of the additional tuned circuit is quite apparent.

LOSS REDUCTION

The improvement shown in selectivity has been brought about entirely by the reduction of losses in the tuned circuit comprising the intermediate frequency amplifier.

Early transformers were wound with solid wire and not much attention was paid to the insulating and supporting materials in the field of the tuning coils and condensers. The use of litz wire, high quality insulation, such as Trolitul, in the tuning coils, together with air dielectric trimming condensers, has effected a reduction of losses and consequent improvement in the selectivity.

The selectivity of a tuned circuit is also directly related to its amplification and a compromise must always be effected between these two factors. Increasing the capacity of the tuned circuit usually results in an improvement in the selectivity, but at the same time with a reduction in the gain.

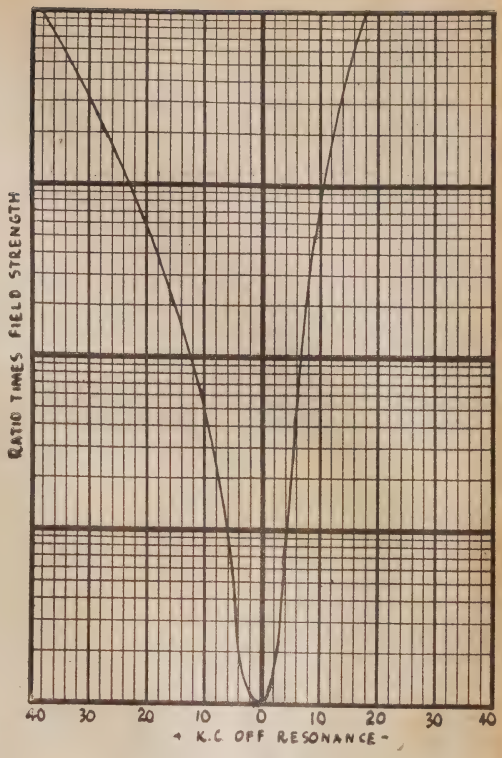


FIGURE FIVE

VALVE LOADING

It must always be remembered that the tuned circuit is loaded by the valves that it is connected to, the input and output resistance of which is quite appreciable, as the tuned circuit has to deliver power to the valves, or is alternatively loaded by the plate resistance. This factor must be taken into consideration when determining the proper ratio of inductance and capacity in the circuit.

Valves having high plate resistance naturally damp the tuned circuit to a lesser extent and consequently higher ratios of inductance to capacity may be utilised.

Figure 5 shows a selectivity curve which is not symmetrical and in tuning a receiver having this type of response a definite tail will be noticed on one side of the signal. The cause of this will usually be found in stray couplings in the intermediate frequency circuits of the receiver, either of a capacitive or inductive nature, and the type of couplings will govern the side to which the receiver responds most to the effect.

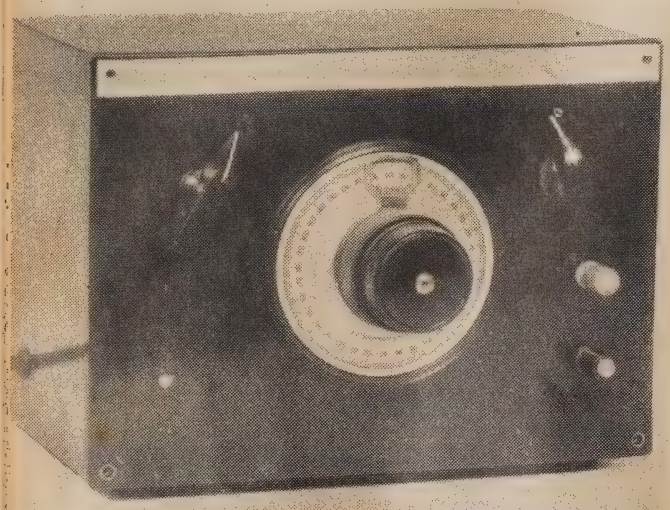
Where a radio receiver is operated in close proximity to a powerful station, interference may be introduced into the receiver from other sources than the aerial terminal. This is usually due to direct pick-up by the wiring of the r ceiver and may be minimised by caref shielding and layout.

In one particular case that came und the writer's notice a receiver which a peared to have excellent selectivity wh tested on a signal generator was fou to be picking up energy from a near local station on the gramophone pick-u wiring in the audio frequency circuit.

Another form of interference whi has been found on superheterodyne r ceivers occurs when the receiver is ope ated in the vicinity of two stations who frequencies are separated by the inte mediate frequency. The selectivity of receiver with this type of interferen may be determined by the two sign input test.

In receivers designed for commun cation purposes where the main requir ment is reception of CW telegraphy si nals, the selectivity may be carried to point where stations separated only a few hundred cycles may be sati factorily received. However, for the r ception of normal broadcast transmissi it is extremely doubtful whether ar benefit is gained by increasing the sele tivity beyond that shown in figure 4, even this introduces serious attenuati of the higher frequencies contained the side bands of the transmission wi consequent boominess and lack of realis in the reproduction.

A simple MODULATED OSCILLATOR for service work



The oscillator from the front. The pointer at the left selects the band required, and the attenuator is at the right. Calibrations for the oscillator are given in a table with this article, subject to slight changes for individual instruments.

☆

Here is a description of an excellent little modulated oscillator which is ideal for the average service man, who can build it himself. The cost is quite low, and the oscillator covers broadcast, short-wave and intermediate frequencies.

By R. LACKEY,
(A.M.Inst., R.E. Aust., Dip. W.I.A., Chief Instructor, Aust. Radio College.)

A CERTAIN amount of test equipment is essential to anyone undertaking the construction and service of radio receivers, for test instruments of various types permit adjustments and measurements to be made which could not be carried out in any other way.

Second in importance only to some form of multimeter is an oscillator. The instrument described in this article is the simplest type which can be made to operate efficiently and has been designed under the belief that there are many who feel the necessity for an oscillator for servicing or aligning receivers, but who hesitate to purchase an expensive professional instrument. No pretence is made that this instrument is to be compared to the splendid looking professional instruments now available on the market. Nevertheless, it is extremely satisfactory, and highly efficient for the student of radio and home-set constructor. Furthermore, the cost of the parts is quite low, and most fellows possess a number of the smaller parts used in its construction.

This particular oscillator will produce a modulated radio frequency signal at any frequency in the intermediate, broadcast, or the most popular short-wave band, and is designed for operation from 240 volt A.C. power mains.

SIMPLE CIRCUIT

A glance at the circuit arrangement will reveal its simplicity. The plate circuit of the tube is supplied with voltage from a 100 volt winding on the power transformer. This alternating voltage applied to the plate will cause the tube to oscillate when the plate is positive and then cease to oscillate when the plate is negative. This will take place at the rate of 50 times per second in the case of ordinary 50 cycle power mains, and will thus produce a radio frequency signal modulated at 50 cycles per second. When signals from this oscillator are picked up by a receiver, the detector stage in the set will separate the modulation from the carrier so that the 50 cycle note will be heard from the speaker as a humming sound. The simplicity of this arrangement saves the cost of a rectifier and filter system and also of a modulator stage, while, at the same time, it permits an inexpensive oscillator which is just as suitable for ordinary alignment and service work as many more expensive instruments.

CONSTRUCTION

One of the most intricate and critical parts in an oscillator of this type is the coil unit. Naturally, three separate coils are necessary to cover the three distinct frequency bands and to provide a satisfactory coverage of each band it is necessary that the broadcast and I.F. coils are "pye" wound in the same manner as the coils in an I.F. transformer. As it is impossible to wind this type of coil by hand, it is best to obtain a machine-wound set of coils. Those used in the oscillator described in this article were supplied by Radio Equipment Pty. Ltd. and consisted of the three coils mounted on and directly wired to the wave-change switch.

To prevent direct radiation from the coils and wiring it is necessary to completely enclose the oscillator in a metal case. A case 10 inches long, 7 inches high, and 5 inches wide will be suitable. A metal shelf should be fastened to the removable front panel and on this shelf and panel all the components are mounted.

The attenuator potentiometer should be mounted in such a way that its shelf is insulated from the front panel. Bakelite insulating washers are provided with

some makes of potentiometers for this purpose.

The first stage in wiring is to run a piece of 16 or 18 gauge tinned copper wire as an earth wire to join up all the points shown in the diagram as connecting to earth. After this, the remainder of the wiring should be carried out in the usual manner.

Almost any general purpose triode tube could be employed as an oscillator, but in this unit we have selected a 57 tube pentode and employed it as a triode by connecting the screen grid to the plate and using these two elements as the plate. The plate wire from the coil kit then connects to these two elements. Two main reasons prompted the selection of the 57 type tube, one being the fact that it is one of the least expensive types available, and the second that it is a very commonly used type, so that should the original fail at any time, a replacement may be on hand or can be obtained with a minimum of delay.

The lug on the right-hand side of the potentiometer, looking from the rear, with the lugs uppermost, should connect through a .01 mfd. condenser to the junction of the 25,000 and 50,000 ohm resistors, while the centre one of the three lugs on the potentiometer connects through a second .01 mfd. condenser to the "red" output terminal.

The power flex for connecting to the A.C. mains should be soldered to the lugs marked 240 on the power transformer and passed out through a rubber grommet fitted in a hole in the end of the metal case.

CALIBRATION

As the dial settings for various frequencies are dependent on the manner in which the instrument is assembled, each oscillator has to be individually calibrated, so the constructor of an oscillator from a kit of parts will either have to calibrate the unit himself or forward it to some organisation which will undertake this work.

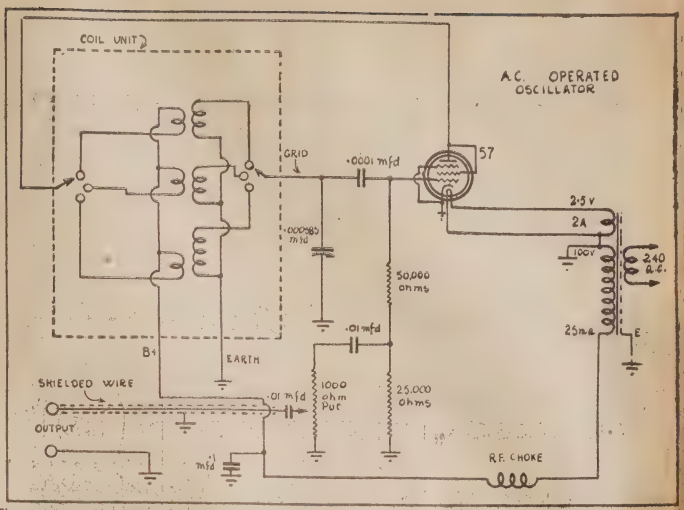
BROADCAST BAND

The broadcast band is the easiest to calibrate, and should be done first. For this work it is necessary to connect both the output terminals of the oscillator and an aerial and earth to the corresponding terminals on a sensitive receiver. Station 2CR, operating on 550 k.c., should be tuned in, the switch on the oscillator set to the middle position, and the dial rotated until the signal from the oscillator beats with 2CR's signal, causing a hum and squeal. The tuning dial should be adjusted until the squeal is reduced to the lowest pitch, and the dial number noted as that correspnding to 550 k.c. Next, Station 7ZL, operating on 600 k.c., should be tuned in, and the oscillator adjusted until the beat note between its signal and 7ZL is reduced to its lowest pitch.

The oscillator dial number is then noted as corresponding to 600 k.c. This process should be continued at points about 100 k.c. apart, right through the broadcast band to 1500 k.c.

The next band to calibrate is the intermediate frequency band, which extends from about 170 to 500 k.c. No

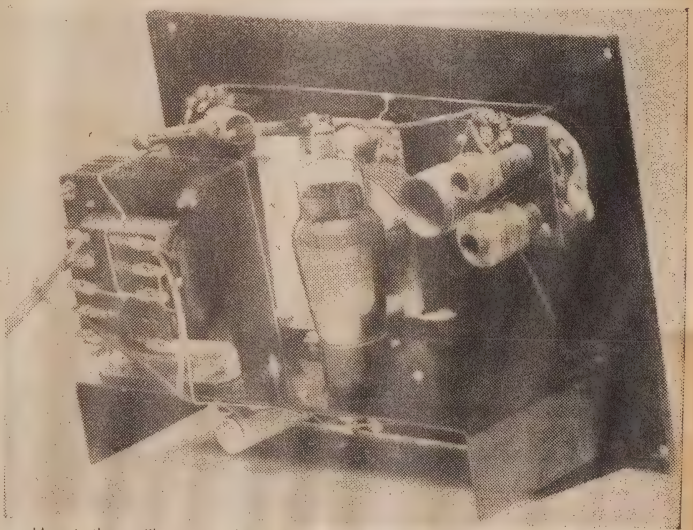
(Continued on Page 21)



The circuit of the oscillator illustrates its extreme simplicity. Note the simple coil unit, to which there are only four connections. The A.C. is used to obtain modulation, at 50 cycles.

CALLIBRATION CHART

I.F. BAND K.C.	Dial.	B.C. BAND K.C.	Dial.	S.W. BAND M.C.	Dial.
170	19	525	8	4	5
175	26	550	18 5	6	38
180	32	600	37	7	59
200	50	610	39	8	73
230	69 5	650	50	9	85.5
240	74 5	700	61	10	97
250	79	740	68	11	108 5
260	84	800	78	12	119
265	86	870	87	13	133
350	122	950	98	14	145.5
370	129	1020	107	15	169
410	142 5	1110	116	16	
427	149 5	1190	125		
450	160	1270	136		
455	162 5	1400	155		
460	166	1500	169		
465	168 5	1525	173		
470	173				

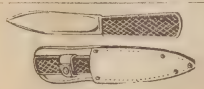


Here is the oscillator with the cover removed. To the right is the coil unit mounted on an insulated plate in front of the switch. The tuning condenser, a standard type, is in the centre of the chassis. At the left is the filament and power transformer, and behind it the attenuator.

Morse Code Practice Sets, with Switch Buzzer to Light. Use as you desire. 22/6 No. 1, complete,

and Heavier Type Morse Key. 30/-, No. 2.

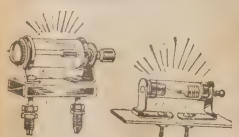
The great Nut, Bolt and Ring Trick, 2/-. It is so easy when you know how. You have to remove the nut to take off the ring. 2/-.



Throwing Knife, perfectly balanced, made in Sheffield, 6/9.

Play, Talk, Sing, Joke through your Radio. Great Fun. Batteryless type Microphone for Hand Holding or Hanging, 22/6. Complete with lead, fixed in a second. Others 12/6, 15/-, 17/6, 25/-, 28/6, 32/6. All plus 1/9 for Battery and 17/6 for 20ft. Cord. Write for Detailed List.

B.G.E. Table Type Microphone. Highly recommended for Amateur or Professional use. Built-in Transformer and Battery with Volume Control incorporated. Just plug into pick-up terminals of any set. 39/6.



Crystal Detectors, as illustrated. A1 Semi-fixed Type Midget Glass Enclosed Type, 2/6. Continental Type, with plug-in pins and sockets, 3/9.

Microscopes, 6/9, 8/6, and 10/6. Sets, 3/11, 12/6, 25/-. The World's Smallest Illuminated Back Panel Dial, 2½in. Escutcheon Plates, 7/6.

Like-a-Flash Cigarette Selling Machines, for Wall or Counter. All Metal. Fool Proof. Two sizes, holds 18 packets of 6d cigarettes. Price, 45/-. Larger size, holds 24 packets of 6d cigarettes. Price, 55/-. Special price in lots of 6 and 12. Traders, write for fullest details quantity lots.

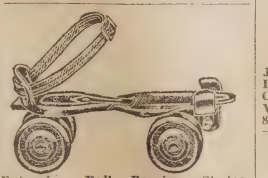
Extendable Periscopes, 3/6.

We stock all kinds of Torches. Inquiries welcomed. Fountain Pen Size Torch, 2/-, complete.

Electric Continental Soldering Iron, 15/-. 150 Watt Heavy Duty Type, 25/-. Goldstone British Manufactured Electric Soldering Irons, 5/6, complete with Flex and 2-Pin Adapter.

Special Prices to Wholesalers and Retailers,

Morse Code Keys, as illustrated. Adjustable all ways, 12/6. P.M.G. Type, 19/6.
Buzzers, 2/6, 2/9, 3/6, 7/6.



Extension Ball Bearing Skates. Steel Wheels, 15/-. Boys' Street Skates, 5/11. Made in U.S.A.

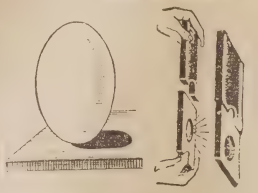
Revolver, just like the Real Thing. Combination Chromiumed Cigarette Case and Lighter-Revolver, 5/6. Novel Revolver Cigarette Case, pull trigger, out jumps cigarette, 3/6.

Microphone Buttons, Large or Small, 4/8, Post Free, with fullest directions for 1000 and 1 uses, for making your own Mike, increasing and reproducing the volume of string instruments, etc., etc.

OFF WITH HIS HEAD

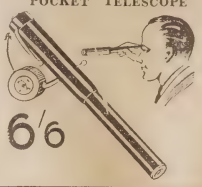
The man they could not Execute

The greatest puzzle ever. A solid blade passes through a solid piece of steel. How's it done? 2/6.

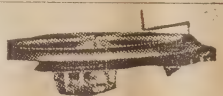


The Egg of Columbus. You can't make it stand up unless you know how. 2/6. A new trick. The reappearing and disappearing Coin Box, 2/-.

POCKET TELESCOPE



Just arrived from the maker in London. "Cosmocord" De Luxe Crystal Pick-up, with incorporated Vol. Control. 48/6. Guaranteed 84/- value. Now 48/6.



Electric 240 Volts Gramophone Motor. All Fittings, with Turntables, etc. British make, 39/6. Send for List of Electric Motors and Gramo.-Radio Units.

Totem — A Little Gamble for Home, Club, Bazaar, or Fete, 21/-. Push Lever, wheels spin for winners and odds. Write for Fullest List of Games.

"Like-a-Flash AC 240 Superhet Mantel Model Receiver, £8/15/-.

Television and Short Wave Book. 5/6. Everybody's Wireless Book, 5/6. The Book of Practical Radio, 8/6. Practical Television, 8/6. A Splendid Publication, the Outline of Wireless, Cloth Bound, by Ralph Stranger, 10/9. The Radio Amateur's Call Magazine, 11/6.

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The World's Famous Lock Trick. It won't open until you place it behind your back. 2/-.

AMERICAN MOTOR CAR AERIALS, Made in U.S.A.

Door Hinge Fixing Model, collapsible, all fittings, 33/-. Motor Car Electric Mudguard Fender Lights, 9/6. Coloured Illuminated Tops. Send for full particulars of other Car Aerials.

Model Electric Motors. Work off Wet or Dry Battery or Transformer, as illustrated. 4/9. Other Types, 8/6, 11/6, 15/-. Small Model Motors, 3/6. Kit of Parts to build Small Motors, 2/6. Small Outboard Boat Model Motors, 12/6, 19/6.

Write for full list of Radio Testing Meters, English All in 1 Meter. Reads everything in Radio, 18/6.

WATES' ORIGINAL POCKET METER—4 RANGE TYPE. Reads—0 to 6.
0 to 15.
0 to 180 Volts.
0 to 30 M/A. 14/-.
Small pocket meters, reads A and B Batteries, 2/6, 3/9.

The All American All Station Crystal Set, with variable coil. All Parts 23/6. Assembled 33/6, in Cabinet 43/6. Phones from 10/6. Charts 6d; free with kit.

"PRESTO" THE MAGIC BOX.

The most Amazing Trick Just Out.

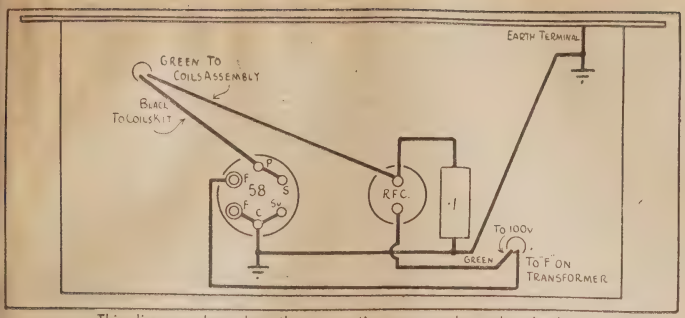
"PRESTO"—The greatest, most alluring and outstanding little Trick ever introduced. 2/9, Post Free. Money back if it's not the best yet.

Now ready, Levenson's 1939-40 4-valve Portable Battery operated Radio, £12/10/0.

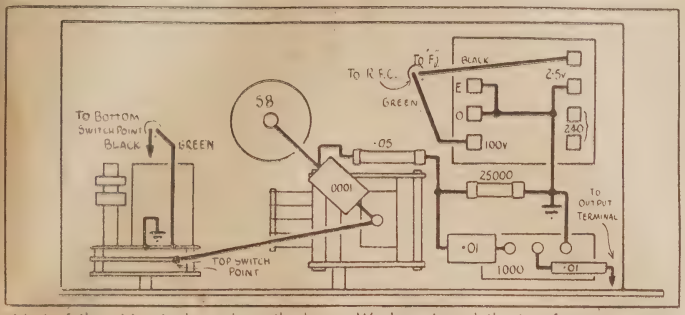
Giant size Packet of Assorted Foreign Stamps 500 for 2/6.

LEVENSON'S RADIO

Wholesale, Retail.. Wholesale, Retail.
Games, Hobbies, Novelties, and Slot Machine Specialists,
226 PITT STREET, SYDNEY.
Everything from A to Z in Radio at Sane Profit Prices.
'Phones, M2525 and M2526-7. Goods forwarded C.O.D. Post or Rail (C.O.D. Rail Within N.S.W. Only, Not Interstate). We Welcome Prepaid Telegrams and Long Distance 'Phone Calls. Send 2d Stamp now for Special Interesting Bundle of Illustrated Literature. Wanted Agents to sell our lines.



This diagram shows how the connections are made under the base.



Most of the wiring is done above the base. We have turned the transformer terminal strip on side to show its connections more clearly.

MODULATED OSCILLATOR

(Continued from Page 19)

ordinary receiver will cover this tuning range, so that it is necessary to pick up harmonic frequencies of the oscillator's signals.

In this instance, set the receiver to some station with a frequency of about 1000 k.c. Station 2KY, with a frequency of 1020 k.c., will probably do, or 2GZ, with a frequency of 990 k.c., could be used. Now start with the oscillator tuning condenser plates turned fully into mesh, and slowly rotate the dial until the oscillator's signal beats with the station. The oscillator will now be operating at half the frequency of the station being received, so that if 2KY is used, the oscillator will be producing a frequency of 510 k.c., while if 2GZ is the station received the oscillator will be working at 495 k.c. The oscillator dial number and frequency should be noted. Proceed to tune in other broadcast stations, working towards the low frequency end of the band in a similar manner. When 2CR on 550 k.c. is reached, the oscillator will be producing a signal of 275 k.c. with the dial about half-way out. Tune the receiver back to either 7LA on 1100 k.c., 4LG on 1100 k.c., or 2UW on 1110 k.c., and slightly readjust the oscillator dial, if necessary, until the squeal caused by the two signals beating together is again heard. The oscillator will now be working at one-quarter of the frequency of the broadcast stations.

Continue to tune in other broadcast stations working towards the low frequencies, and follow with the oscillator dial, noting down the corresponding dial numbers and frequencies, but remember in this instance to divide the broadcast station's frequencies by four.

THE SHORT WAVES

The short-wave band can be calibrated in a similar manner to the broadcast band by tuning in various short-wave stations together with the oscillator signals on a short-wave receiver.

As mentioned previously, the dial settings of individual oscillators will vary within a few degrees, but the following chart will give an approximate indication within about 5 degrees of the dial settings for the more commonly used frequencies in the three bands.

SPACE WINDING COILS

AN EASY METHOD

WHEN winding space-wound coils it is often difficult to maintain even spacing and at the same time to wind a tight coil.

The easiest way out of the difficulty is to wind on some ordinary string side by side with the wire itself. The string is unwound after the coil is completed and the wires will be evenly spaced according to the diameter of the string employed.

Obviously, thin string will space the wire a less amount than will thick string. You will need to know the approximate spacing required in order to select the right thickness. Copper wire may be used in place of the string with equally good results.

ON THE AMATEUR BANDS

☆

by A. V. Bennett

TWENTY METRES COMES GOOD DX BACK AGAIN

Twenty metre phone DX is coming into its own again, and is exerting a very strong attraction on many of the amateurs of VK. During the past month, strong American signals have been more consistent than formerly, and many of the old familiar voices in the States and Canada have been rattling our speakers in the well-known R9 manner.

T is noticeable that the peak period does not last long. The W9 district seems to have been most consistent during these peaks. W6BKY has been coming through on some evenings, and when one tunes across his frequency a hurried manipulation of the audio volume is required.

Undoubtedly, the 20-metre band is improving, and during the coming month it should be possible to enjoy a fair amount of success, provided one can find a clear spot on the band.

European phone signals are not prolific, either in the morning or during the evening. VK3s and VK5s seem to be enjoying most success in this direction. It is possible to hear Victorians working English and French stations on occasions, but the most diligent search on this end shows no signs of overseas stations.

Conditions on c.w. are much better. The hours 6-7.30 a.m. have proved good for c.w., and are still improving. Numbers of South American stations can be worked at this time; three consistent S. Americans are YV5AC, CE2AG, and CX1CB, on the high frequency end of the band, consistent European stations are too numerous to mention, especially English and French ones. They start on 20m.

A remarkable thing in present-day amateur radio is the choice of frequency of chaps who have just gained their tickets. The old method was to start up on 80 or 40, and then, after experience, gradually migrate to twenty and ten. Now it is the reverse, and most newcomers have worked dozens of W's and have a list of countries in their first month. They can also usually boast the latest in beam aerials, transmitters, and receivers.

ACTIVE OPERATORS

Operating during morning periods, VK2ACX has worked over 70 European stations during the last month on c.w. Not bad going, when one considers the short time available each morning.

VK2AGJ of Roseville, is cleaning up American phones in great style. His beam antenna is pictured here, and certainly does its job well. A call which, about a year ago, was very familiar on this band, especially during DX tests, but which disappeared for some months, is back again with a very efficient phone signal. VK2KS is the call, and Leo is making up for the DX time he lost when he temporarily succumbed to the lure of the open road, per medium of motor-cycle.

SHORT SKIP

At times the skip on twenty has been very short, VK3 and VK4 stations causing as much qrm. as locals, the case, of course, being reversed in their States. VK4 amateurs are working their share of DX, mornings and evenings, VK4JP, fKA, and 4JU being very consistent.

BEAM ANTENNA

There can be no doubt about the popularity of the beam antenna, especially of the rotary type. Many fine examples are being used in and around Sydney, and reports of them are very favorable.

During a recent conversation with W2AZ, that outstanding American exponent of the beam antenna, he gave a very interesting description of the various beams he is using.

The antenna for 20, pointed in this direction, is an eight section W8JK, used both for transmitting and receiving. There are various antennae for each direction, and each is aligned accurately, so that it is possible to switch across to any one antenna without the necessity of returning the final amplifier.

In passing, W2AZ said that the only trouble he had had with the 8JK was when poor insulation was used.

When the antenna became wet or damp, the tuning of the array was seriously affected, making it difficult to switch beams and retain the same loading conditions. W2AZ has worked 106 countries on phone. Something to chase!

FORTY METRES LITTLE CHANGE

★

Forty seems much the same as last month. Enthusiasm on this band is not lacking. Some interesting tests are carried out during the mornings.

Most of us are still in bed at the time, and the few energetic ones take advantage of clear channels for tests and rag-chewing. European stations are not numerous.

One good contact is YI2BA, on 7100 k.c., with a note which is about T3 at times, but R6 to 7. This station is in the same zone as VU2AN. It seems, however, that YI2BA may have a poor receiver, which is always a comforting thought when no reply is received to one's signals. He was operating on twenty early last year, and much power was expended on him with very little return.

Atmospheric conditions have been better on forty during the past month, and contacts during the winter months should be more pleasant in this regard.

COMMERCIAL STATION

It has not taken long for French commercial stations to take advantage of the 100 k.c. allocation in the forty metre band. According to the new regulations, the band was not to be used by commercials until September 1 next, but that has meant very little to French commercial interests. One station, at least, is in full blast, and it comes as a surprise to find it when tuning across the high frequency end of forty. American amateurs have taken a strong stand, and have made dire threats of blasting the commercial stations off the band. However, fifty watts, as used here, would be of little use in this direction.

This brings to mind our own local affairs. The Radio Inspector's Department asks for the co-operation of all amateurs, and more especially those using phone, in conforming to the regulations, and in operating their stations in a true amateur manner.

Many amateurs have come in for adverse criticism, due to the few unthoughtful operators who carry on in a manner which certainly does not help the amateur cause in the minds of the people who now listen on the short waves, and the authorities whose job it is to police the bands.

BETTER PHONE ON EIGHTY METRES

There is very little to relate about the eighty metre band. Many fine business phone stations are operating on this band, and the quality of most of them is excellent. Over-modulation and blasting, which at times is over-prevalent on the higher frequencies, is noticeable by its absence.

Operation on this band is not of the hurried and scrambled variety—operators do take their time, and exchange more than the bare QRK. As an old-timer remarked, "You can always enjoy a decent QSO on 80. Down on 20, the boys hunting for 'CQ DX' sound like a lot of dogs howling at the moon." Unflattering, but not too inapt.

From reports received, American amateurs are making good use of the eighty band for DX work. ZL2BE and ZL2BN are heard and worked consistently in America on this band, most of the contacts being on phone. So far, there is no news of recent DX contacts by Sydney amateurs on the 3.5 mc. band.

Listening on 160 metres is not very encouraging. Absolute quietness, with occasional bursts of static, seems to prevail. This band seems shunned by all. It is a pity that more use is not made of it. Of course, one big drawback is the choice of an antenna. Very few hams have room enough to put up a Hertz, and the antenna decided upon is, in most cases, the half-wave zepp, used as a grounded Marconi.

TEN METRES

The ten metre band has not been at its best at all, signals fading out before a decent contact can be made. The W's and K6's are also experiencing the same trouble, and conditions between Europe and America have been very poor.

It looks very much as if ten metres is going to close up still more during the winter months.

MORE INTEREST IN 5m.

AUSTRALIAN-WIDE TESTS

Increased activity on five metres is to be the trend this winter. tensive plans are being made by individuals and groups of amateurs, to vestigate thoroughly the vagaries of this increasingly popular band.

The recent record made by VK2LZ and VK2VU, between Wentworth Falls and Singleton, a distance of 100 miles, has placed broad smiles of satisfaction on the faces of pioneers who have spent much time and effort experimenting on this band.

It justifies many of their claims, and, with a greater number of stations operating in the coming months, it is expected that many new records will be set.

The W.I.A. has reorganised the Ultra-high Frequency Section, which was operating so successfully some time back.

The most popular type of antenna used on this band is of the vertical variety, both for receiving and transmitting, so, when you get round to constructing a receiver, use a vertical type antenna to gain the correct polarisation.

Messrs. R. and E. Trehearne, VK2IQ and 2AFQ, have been operating on five for some considerable time, and a visit to their shack proved very interesting. They are using the best type of equipment, and their general lay-out is all that could be desired. A pair of 800's is used in the final amplifier.

These excite a vertical W8JK beam, which is rotatable. The receiver used is a converter, with an 1851 RF stage, followed by a 6J8G as a converter, fe ing into their low frequency commu cation receiver.

Ross and Elgar have made reco of all interesting transmissions wh they have made on five metres over last few months. It is certainly effective method of keeping a compl log. Very little is missed. The reco are excellent reproductions of various transmissions. An automa CQ wheel is another of their no ideas.

Recent five metre tests carried out Western Australia did not produce a record-making feats. The longest c tance covered was sixty miles, but large amount of experience was gain and the boys there had plenty of fun

Information received from VK3DA the activities on five in and arou Melbourne shows that there are nu bers of amateurs very active there. least twelve stations are operating d ing week-ends. Most of the transm ters are crystal controlled, and dir tional beams are being used.

At the present time contacts mainly confined to local rag-chewi but a sharp ear is being kept open the opening-up of the band, or for so interstate signal to show through.

A test was recently carried out tween Tasmania and Victoria, but signals were heard on either side. U favorable weather in Melbourne at time made things a little unpleasant

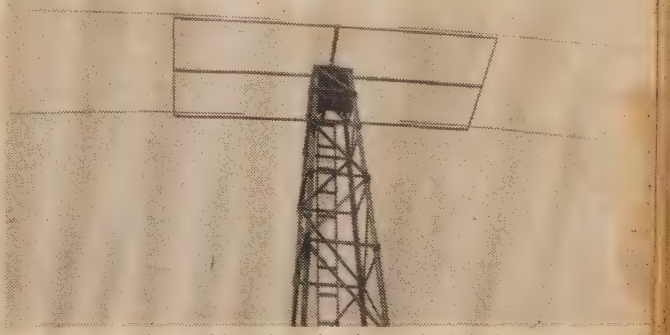
ROTATABLE AERIAL AT 2AGJ

The beam is similar to one described recently in the American "Radio," and sits atop a 40-ft. mast.

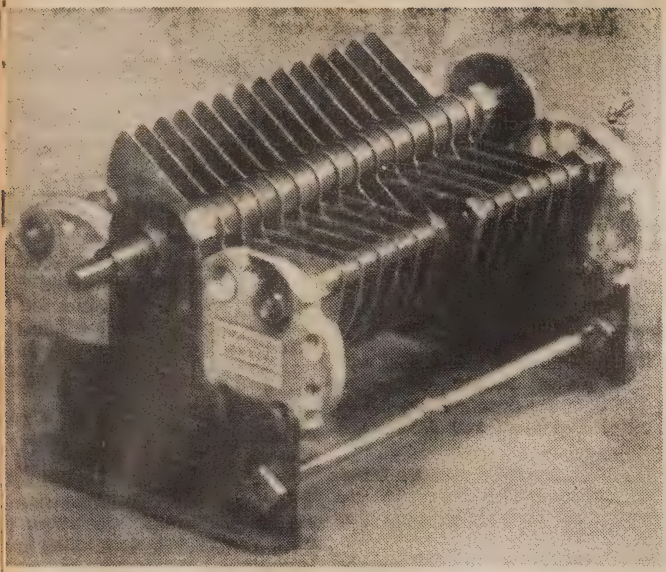
It is rotatable from the shack by means of weather-proofed ropes, and it is appropriately "steered" by an old motor car steering wheel.

In future, 2AGJ hopes to try out several arrays mounted on his tower, and should be able to get fine results from his good location.

N.S.W. BEAM AERIAL



Mr. R. J. Mitchell, VK2AGJ, sends us this photograph of the beam antenna he ha erected at his home in Roseville.

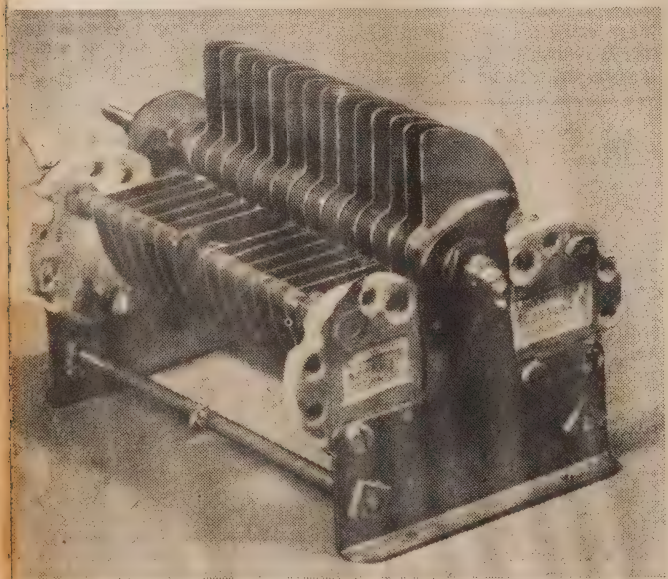


ABOVE:

This photograph of the condenser shows most of the mechanical details. Compare the end-plate as shown in the picture, with the outline drawing on the next page. In conjunction with the drawing, the mounting of the insulating support is quite clearly shown. This is the front end of the condenser.

BELOW:

The condenser from the other end. It is a split-stator model—you will notice that the two stator sections are bolted back to the end-pieces. The brass rods running from end-piece to end-piece hold the assembly firmly together.



Making

By A. J. BARNES

WHEN building a final amplifier for telephony tranmission on the higher frequencies we usually find that the choice of a suitable plate tuning condenser presents many problems. Insulation is important; invariably a ceramic is indicated. Spacing of the plates must be ample in order to withstand modulation peaks without flash-over. Finally, good circuit design calls for split-stator construction.

Some time ago we had occasion to inquire about such a condenser: "Yes, we will have to build specially; this will take about two weeks and the price will be —." Indeed, the price quoted would just about cover the cost of a new work-suit. We bought the suit—and we built the condenser!

PARTS LIST

8ins. by 4ins. by 16 gauge sheet brass.
12ins. by 3-16in. brass rod.
1 old variable condenser (see text).
1 piece of brass rod for rotor shaft.
4 ceramic padder or intermediate bases.
2 bushings with nuts (see text).
Sundry screws, nuts and washers.

We can quite imagine the ironical laughs when we repeat the well-worn phrase, "Most of the parts were found in the junk box." Such is the case, however! We spent five shillings on sheet rod and tubular brass, together with sundry nuts and washers.

THE PLATES

These were removed from an old-time tuning condenser, which had the very convenient features of semi-circular plates with loose spacers and clamping bolts. We made a host of new spacers by placing the brass tubing in a lathe and parting off pieces of the required length. This brass tubing would slide nicely over a 3-16 inch brass rod lengths of which were threaded and cut to form two pairs of stator rods and one pair of end-plate brace rods. A new and longer rotor shaft was made and as it was of larger diameter than the stator bolts we had to make the rotor spacers from larger tubing. A nut on each end of the rotor shaft held the assembly of plates and spacers together.

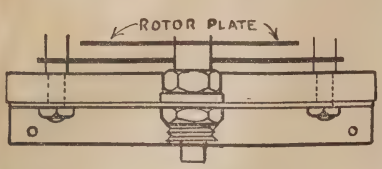
THE END PLATES

These are cut from 16-gauge sheet brass; the bottom edge is bent at right-angles to give rigidity and to form a mounting flange. The upper corners are cut out and in their place we bolt ceramic trimmer bases taken from old intermediate transformers. No doubt, other forms of insulation could be used,

A TRANSMITTING CONDENSER

for your transmitter

Here is an article which every amateur should keep his files, even if at the moment he has no use for Everyone has wanted a good transmitting condenser f an amplifier stage at some time or another. This co denser is not only quite easy to build, but is just efficient as any you could buy. If you don't mind a litt trouble in construction, you will be proud of the job wh it is finished. We have used the padder bases as insulat in a number of rebuilt condensers, and can vouch for t soundness of Mr. Barnes's design.



This drawing gives an idea of the detail involved in the rotor support bearings.

but a very convenient feature of the trimmer bases lies in the fact that they are of ceramic material with holes "all over the place"; thus, we can easily find suitable mounting holes for bolting to the end plates as well as for supporting the stator sections.

The centre projection is drilled to take a bushing and nut. These were robbed from old rheostats and form the rotor shaft bearings.

These two identical end-plate assemblies are held together at the required separation by two long 3-16 inch brass rods near the bottom; the rotor assembly forms the top bracing.

CONSTRUCTION

Cut two rectangular blanks of 16-gauge sheet brass and tack together round the edges with solder. Mark out and drill to suit the condenser plates. To bend the bottom flanges place in a vice with bottom edge projecting half-inch above the jaws. Open out by driving a chisel between and then hammer down at right-angles. Melt out the solder and clean up with emery cloth. We now have two identical end-plates to which we bolt the trimmer bases.

Each end-plate supports a stator section as well as one end of the rotor assembly.

Assemble rotor plates and spacers to rotor shaft and fit a nut on each end.

Cut and thread four rods of length to suit the stator sections plus a little to spare and assemble plates and spacers with nuts on each end of the rods.

Fit one end-plate assembly to each end of the rotor and then screw a nut on each end of the rotor shaft.

Fit the two bottom brace rods, making sure that the end-plates are parallel.

Fit a stator assembly to each end-plate, using thin washers to secure proper plate spacing.

POINTS TO WATCH

Illustrated overseas advertisements will indicate the tuning capacity that can be expected from various combin tions of plate size and spacing.

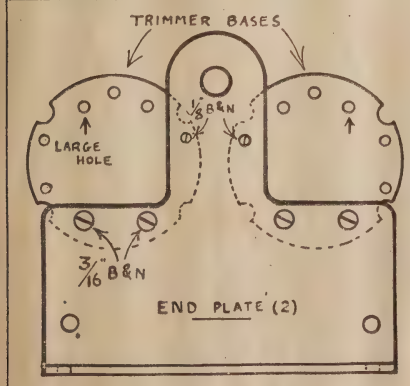
Be sure that the inner nuts of t stator assemblies, are not closer th twice the plate spacing.

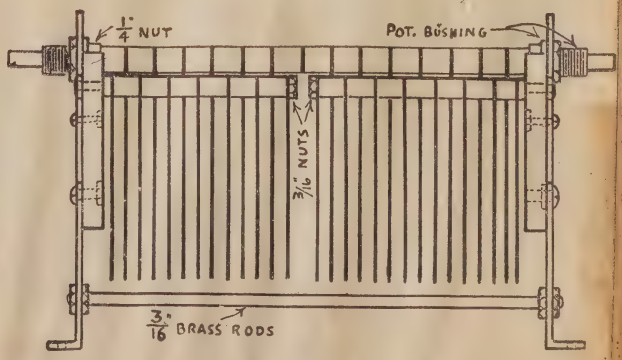
Proper spacing should also be obser ed between such places as the ro shaft and top edges of stator plates, &

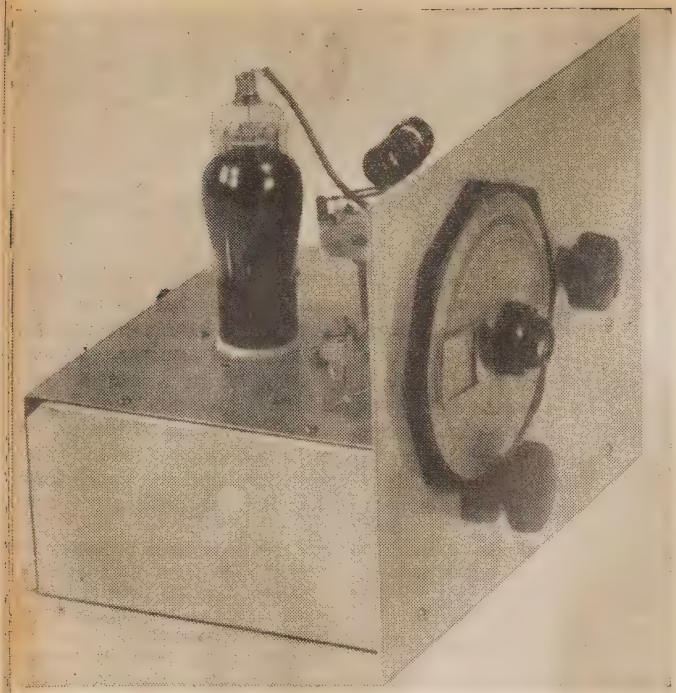
The condenser in the photogra (QRT for photographer) works d at 50 mmf per section. The plate spa ing is 1-8 inch actual.

Many people think that because th are using a low-powered transmitter, man-sized component such as this wo be out of place. This is quite erroneo —there is quite enough "soup" floati round a 50-watt plate tank in these da of good efficiency to call for the be A condenser such as this sho enable you to forget flash-ov and such-like troubles; ev if you have a special pe mit, and are therefore able use more than 50 watts. It equally suitable for push-p or single-ended amplifiers.

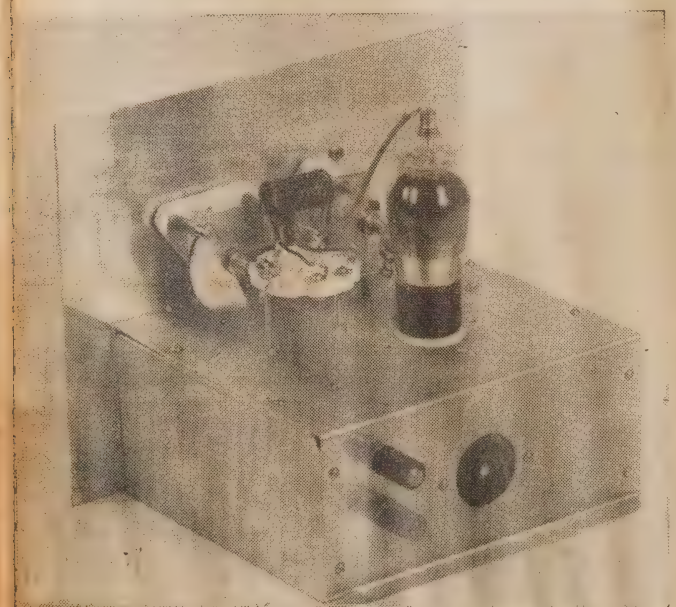
The dimensions and shape of the end-plates are shown at the left, also the positions for the insulating bases. Each end-plate is the same size and shape. To the right is a drawing of the condenser from the side, showing various dimensions you will need to know when making it. Not very difficult, is it?







The converter uses separate tuning for oscillator and signal frequency circuits. The vernier dial tunes the oscillator, of course, and may be of any good type. Note the Steatite socket for the 6K8G.



A back view. Note the intermediate Calit base supporting the aerial and grid coils. The output terminals are shown, and the socket for power connection. The grid tuning condenser is at about 59 megacycles, at the setting shown.

The 2 J U

MOST amateurs have heard of the fun to be had on the 5-metre band, and many have, at one time or another, tried their hand at building gear to work on this frequency.

There is, however, one big disadvantage of five metres from the amateur's viewpoint. It is cost!

The range of 5-metre equipment is, of course, much less than that of the lower frequency bands. In the main, it is a local communication channel. From time to time longer distances are covered, and the best part of 200 miles has been covered in Australia. There are on record distances of several thousands of miles being spanned by five metres signals, even as far back as 1928 or so.

From the amateur's point of view, it represents a happy hunting ground for experiment. The man who has gone blase about constructional practice on 20 metres and up will have to scratch his head anew on five metres. He will find himself up against a new and absorbing technique which, so far, has only been touched upon.

At the same time, there is no need to run away with the idea that it is difficult. Actually, the apparatus to be used is of the very simplest nature, just as simple as that which in the past was universally used on the other bands.

SIMPLE GEAR

We are of the considered opinion that it is foolish to expect the average amateur, with his limited resources, to build large transmitters and receivers simply for local contacts on five metres.

If, however, designs can be presented for simple and effective apparatus which can use the same valves as already are used in his present transmitter, and receivers which are relatively inexpensive, the ultra-high frequencies will come within the reach of practically any amateur.

Therefore, we are working at present on some simple apparatus, both for receiving and transmitting, which will get away from the unsatisfactory makeshifts popular to date.

THE CONVERTER

This month we are describing a single valve converter, which can be used with any good amateur receiver capable of tuning just a little above 40 metres. The converter is given here, designed for the five-metre band, but it is equally applicable to 10-metre work by changing the simple coils which it uses.

The cost of the converter is quite low —the amateur could probably put it together for a couple of pounds. When in use it has changed his ordinary short-wave set into quite a powerful five-metre superheterodyne, which will give him excellent results.

FIVE-METRE CONVERTER

for your S.W. Set

This is the first of several articles, by our Technical Editor, concerning ultra-high frequency development and apparatus. This converter has been very carefully worked out for use with an ordinary Short Wave set, and as such, will give excellent reception of signals in the 5-metre band. It can also be used with good results on 10 metres. Immediate results can be expected if it is built strictly to instructions.

The short-wave set, when tuned to about 42 metres or so, operates as the intermediate frequency amplifier and audio stage, the tuning end being incorporated in the converter itself.

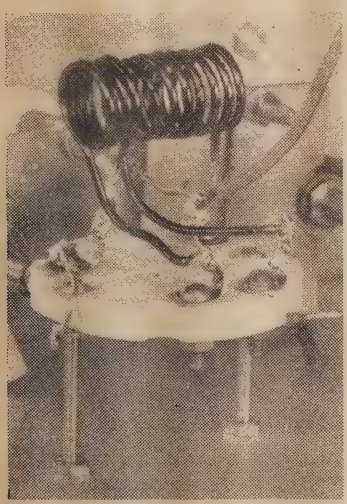
If your present short-wave set is a superhet, this means that there is a double change of frequency—one in the converter to about 42 metres, and again in the receiver proper, to 465 kc, or whatever the intermediate frequency happens to be.

Even a good T.R.F. set should enable good results to be obtained with the converter, although a superhet of four valves or more will, of course, be better suited.

CONNECTION

The connection of the converter to the set is simple. We advise the use of a coupling link of twisted flex to the receiver, connected just as would be an ordinary doublet aerial. The converter includes a special coupling coil tuned to about 42 metres (actual setting not critical), so that a fairly good impedance match is obtained.

The aerial itself is now connected to the converter aerial coil. Again we advise the doublet connection, the aerial leads being clipped to the mounting lugs for the aerial coil, or to a couple of terminals, which may be mounted on the chassis if desired.



A close-up of the aerial and grid coil. The base is supported on long bolts. Bolts and solder lugs through convenient holes are used for coil mounts. The aerial is clipped straight to the ends of the aerial coil. Terminals may be used as in normal practice, if desired.

PARTS LIST

1 Base, 6 x 6 x 3.
1 Panel, 7 x 8.
1 Vernier dial.
2 2-plate midget condensers.
2 Good quality trimming condensers.
2 50,000 ohms resistors.
1 50,000 ohms resistor.
1 300 ohms resistor.
4 .01 mica condensers.
1 .00005 mica condensers.
Sockets—1 octal, 1 4-pin.
2 4-Pin plugs.
4 Terminals.
1 6K8G valve.
Sockets or padder bases for coils (see article).
14 Gauge wire for coils.
2 Inches of good former, 1in. diameter.
1oz. 26 gauge enamelled wire.
Hook-up wire, &c.

The power for the converter is obtained from the short-wave set. It will require connection to a six-volt filament winding for the 6K8G, and two more connections for plus and minus 250 volts or so. This can be tapped off the end of the set's voltage divider, or any convenient point on the high-tension lead.

Our connection was made by a four-pin socket mounted at the side of the short-wave set, into which a four-pin plug from the converter is fitted.

The leads into the converter chassis can either be soldered directly into the wiring or brought to another four-pin socket to coincide with the one on the set.

The converter stands at the side of the set, so that all the connecting leads are quite short—not more than about nine inches long.

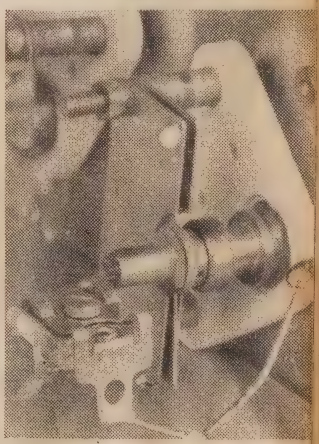
This is a better idea than having a self-contained power supply, mainly because it is cheaper, and the extra drain won't overload the power supply of the average receiver.

RESULTS

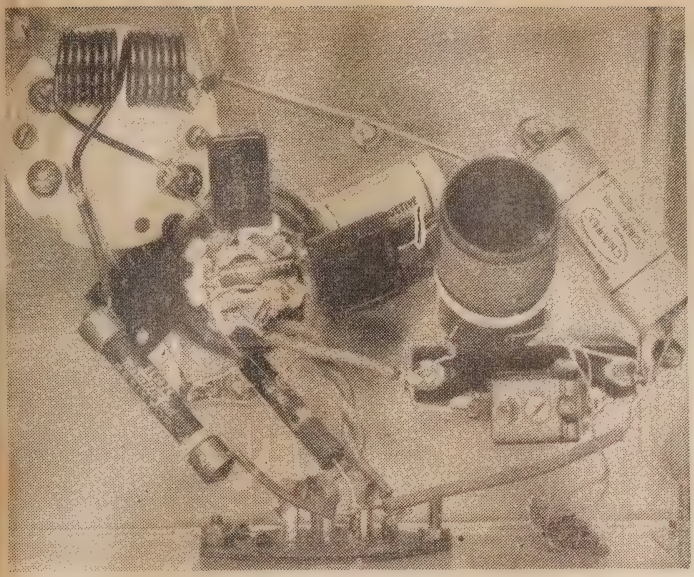
The results one can obtain from the converter speak for themselves. In the past, modulated oscillators have been used as transmitters, with super-generative receivers. The transmitter, as can be imagined, suffered from frequency modulation, which caused them to occupy more than their share of the band.

The super-regenerative receivers were easy to get going, and were so broadly tuned that the frequency modulation didn't worry them.

However, with a superheterodyne the tuning is really sharp. So sharp that badly modulated signals are difficult to follow.



A close-up of the oscillator tuning condenser, C2, and the trimmer across C3. Note the earth wire running down under the chassis to provide the shortest earth return path.



Every component under the base is shown here. Note oscillator coils. The output coil and trimmer, C4, are in the foreground, supported on an insulated strip. Try to earth all by-pass condensers, etc., to the same point. Not much gear required?

This is a good thing, because nowadays it is not hard to build up something better than a modulated oscillator, and any such transmitter, even though it employs but two stages, will be perfectly received on this converter.

In U.S.A. it is an offence to employ any but a stabilised transmitter on five metres, and, fortunately, better transmitters are now becoming the order rather than the exception.

In the matter of sensitivity we have two super-regenerative receivers in th lab., each of three valves. Neither these sets is in the picture when it come to noise level and sensitivity. In othe words, the converter, costing only fraction as much as these sets, can giv infinitely better results.

CONSTRUCTION

Nor is the converter hard to buil Ours worked right from the moment w turned it on. There is no trouble at a to get the 6K8G oscillating down on fi metres, and, once this has been achieve it is only a matter of finding the bar and adjusting the coils.

We fancy there is something about th sound of "five-metre superhet." whic frightens so many who have no need be frightened by it.

For the benefit of these readers w have taken considerable trouble to giv the very fullest details of the coils used in the actual receiver, with close-u pictures of their mounting. These shou make quite clear every construction detail and enable you to duplica exactly the results of the original.

GANGING

It is possible to gang the two tunin condenser, and make the coils track judicious pruning. We built this con verter from the ground up, in four di ferent ways, until we convinced ou selves that, for a start, it would be b better to tune both circuits separate. The ganged version we liked best fro a lay-out point of view, but could dete no difference in results, no matter ho we built it.

Quite a good version used the val lying on its side, with both coils abo the chassis, but we didn't like the lo of it. Our layout, while we don't s it could not be improved, you will fi a sure-fire arrangement.

THE CIRCUIT

The circuit is very simple and us very little gear. It revolves round t use of the 6K8G as a mixer.

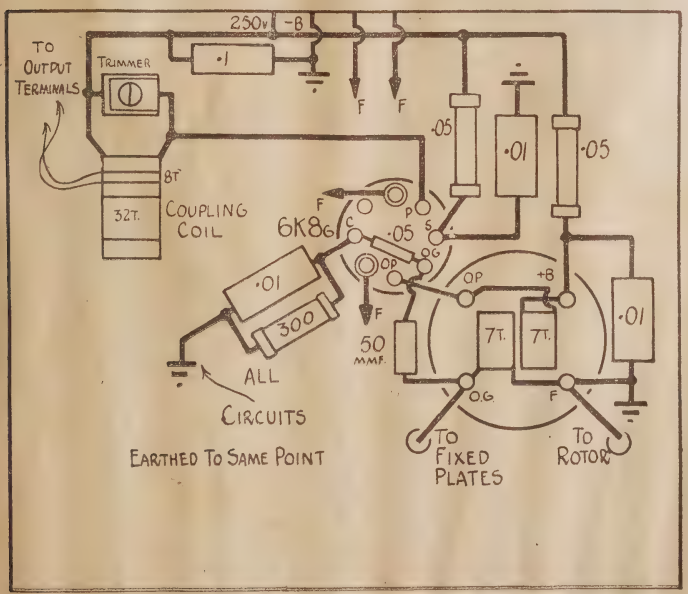
There are two valves which are the picture at the moment as mixers five metres—the 6K8 or 6K8G, and t 6J8G.

Both these valves are able to gi results which are comparable, if n a little better, than the use of a mix and separate oscillator. Some advoca one valve, some the other.

The essential difference is that t 6K8G is an electronically mixed val in that the same cathode stream flo through the oscillator section and t pentode section, thus mixing the together. The 6J8G has two sectio entirely separate from each other, triode oscillator, and a pentode amplifi

The pentode has a special injecti grid, just as has the 6L7, but connecti with the oscillator circuit is made inter ally. It is, therefore, similar to the 6 with its separate oscillator, all be housed in one envelope.

In operation on five metres we pre the 6K8G. Its plate resistance is n as high as that of the 6J8G, which, w suitable output coils, can give, therefo a better amplification. But its grid inp characteristics of the 6K8G are bett which means that the first tuning circ peaks much more sharply. In this co



The wiring in point-to-point form. Note correct connections to the coils. Earthed points shown separately to simplify the diagram. If the 6.3 volt winding in your set is earthed at one side, earth the same side at the 6K8G socket. We didn't find this important, however.

rter this is a very valuable feature hen striking resonance. Without that ak it is often almost impossible to tell hen the coil is actually tuned to the ht frequency or not, at least by observ- the noise level.

Again, there is a coupling effect in e 6K8G itself, which causes it to be ghtly regenerative in the pentode sec- n when operating on the higher fre- encies. It is due to a space-charge ect within the valve. Without some ntrol of screen voltage it can oscillate th no aerial load. By adjusting the rial coupling, as we do with a regenera- e first valve in a short-waver, we can ep this under control and obtain re gain.

Lastly, the oscillator grid voltage char- eristics of the 6J8G are extremely tical, while those of the 6K8G are not. is easy to get good performance from latter with grid current ranging m 120 to 250 micro-amperes on five tres, while the 6J8G, for best results, far more touchy. Although it might possible, with everything just right, get a little more from the 6J8G.

UTPUT COIL

We have selected an output frequency t above the 40-metre band because st sets amplify well in that region, d it is easy to tune just above the -metre band on most short-wavers.

n the plate circuit of the 6K8G there a coil, tuned to this frequency by a all postage-stamp type trimmer, C4, ing as an intermediate transformer. is is coupled to the receiver by a coil a few turns to provide a reasonable pedance match with the average aerial l.

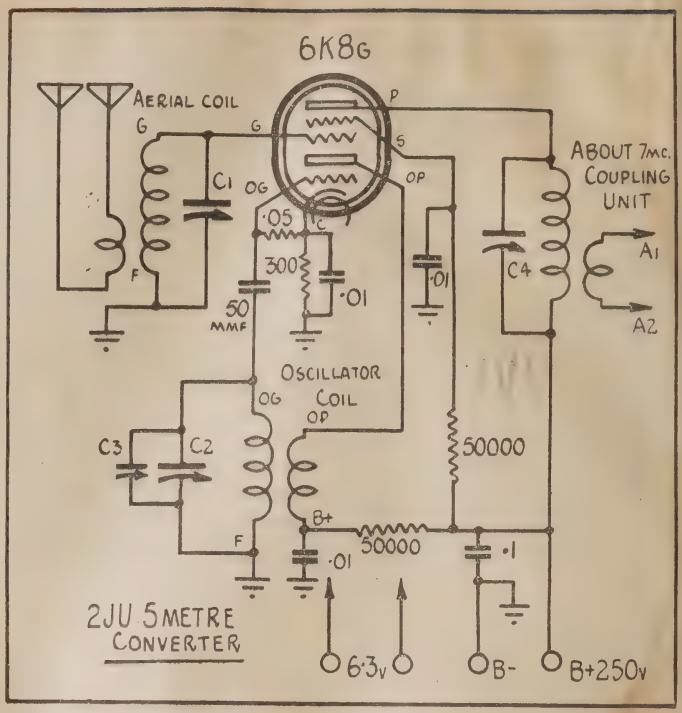
Thus, when using the converter, it is ply a matter of tuning the set until general noise level tells you that have struck the frequency of the verter's output circuit, and all is l, just as you would normally line up intermediate frequency transformer. The dial we used is an old type we d on hand, but more modern dials readily available. Raymart make very good one.

IE COILS

n order that you can exactly dupli- e our coils, we have given a line awing of those we used, with exact nensions and spacing. One of the ficulties is to strike the five-metre nd when you are ready to tune up. If wind things exactly as indicated you ould have no trouble.

We wound the coils round a ½-inch wel, afterwards removed, with 14- ge insulated wire. All the coils have en turns, except the aerial coil, which s three. The grid coil is spaced out r one inch, and the oscillator grid d plate coils are close wound. The ial coil also may be close wound, or y slightly spaced—this isn't at all tical.

Good quality bases as used for inter- diate transformers are used to mount coils. Any shape will do, as long as u can mount things conveniently.



The circuit illustrates the straightforward nature of the unit. Here is 5-metre reception simplified!

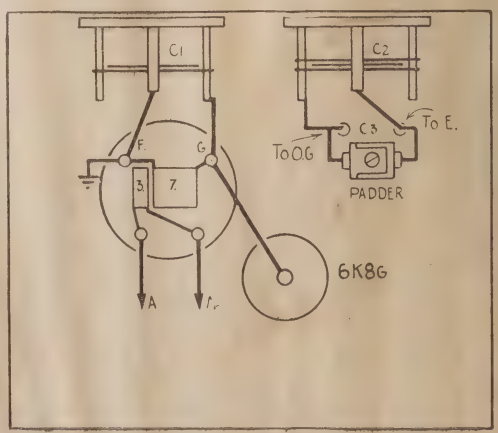
Isolantite, porcelain, Calit, or any other good insulator may be used. Don't use bakelite unless you have to.

The aerial grid coil and aerial coil are mounted above the base, to allow a reasonably short grid lead. Leads run across to the tuning condenser. We soldered a piece of braid copper to the end of the rotor to make a direct connection to the earthed end of the coil. If you solder this braid dead in the centre of the spindle it will twist quite all right without breaking. This earthed end of the coil is also connected to the chassis, of course.

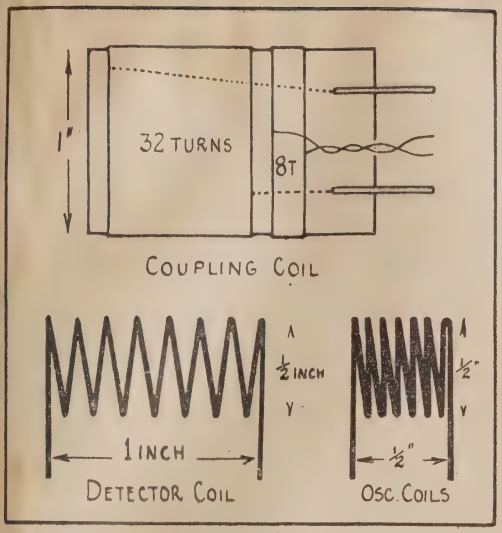
The oscillator coil is mounted under the base, where it allows short leads to the socket. The leads to the tuning condenser run through the base. As this circuit is high-C, anyhow, it doesn't matter so much about the stray capacities.

The two coils are placed up against each other, with about 1-16th of an inch between them. The grid and plate connections are made to the outside ends, and the earth and B plus leads to the centre ends. See wiring diagram.

If possible, make all your earth returns for bypass condensers, &c., to the same point. In our diagram we haven't done this, as it would be impossible to make a clear drawing that way. The



This diagram shows the connections above the base. All these diagrams are drawn strictly to scale, the base being 7 inches by 6 inches.



From this drawing, you will obtain the exact sizes for all the coils. As it is so important to have them right, we have given here everything you want to know to wind them. We used 14 gauge enamelled wire. For the coupling coil, 26 gauge enamelled or otherwise will do. Oscillator grid and plate coils are exactly the same.

photograph indicates that our central carthing point is just hidden by the coupling coil. Points connected to the chassis elsewhere should be joined with 16-gauge tinned copper wire, or you can use some of the 14-gauge you used for the coils.

OSCILLATOR TUNING

Now for an important point which is not always explained as it should be. Our grid circuit is, of course, tuned to the signal frequency, which we will assume is right on 56 megacycles, the lower limit of the band. Now we wish to obtain a beat note of, shall we say, seven megacycles or thereabouts (round about 42 metres). This means that we must tune the oscillator circuit either above or below the signal frequency circuit, by seven megacycles, or 7000 kilocycles.

In other words, the oscillator section must be on either 49 megacycles or 63 megacycles.

Now, for various reasons, it is best to use the lower frequency or 49 megacycles.

We can do this by using a bigger oscillator coil and the same capacity across it, or the same oscillator coil with a larger capacity. The "High-C" theory still holds good here, so we choose 49 megacycles as being the best.

To reach this (about six metres) we have wired a postage-stamp trimmer, C3 (one of those easily obtainable with a clear base) right across the oscillator tuning condenser, C2, above the chassis, where we can adjust it easily. As the total "lumped" capacity of the circuit is greater than that of the grid circuit, we must use now a larger tuning condenser to make sure of covering the band in oscillator tuning.

Therefore, we used a two-plate Raymart condenser for the grid tuning, C1, and a three-plate, C3, for the oscillator. If you can't get a three-plate, you can easily remove one of the rotor plates from a four-plate type, or even use the four-plate type, and have the tuning a little bit more crowded on the dial.

We will later explain just how to find the band with this arrangement.

As we have shown, the coupling coil has 32 turns of 26-gauge wire, just as would be used to strike 40 metres with a very small condenser.

The output coil has eight turns of the same wire, spaced about 1-16th of an inch away from it, and is connected to two output terminals at the back of the chassis.

LINING UP

Now we come to the lining up of the unit. Having made sure all your wiring is O.K., plug in the converter, attach the aerial and power connections, and switch on. When the converter has warmed up, touch lightly with a pencil the fixed plates of the oscillator condenser. In a shaded light you should be able to see a tiny little spark as you touch it, and remove the pencil. At the same time you will hear a double click in the speaker. This indicates that the 6K8G is oscillating.

Now tune your set just above the 40-metre band, where there are no signals to be heard, and turn up the gain till you can hear plenty of noise level. With a screwdriver adjust the condenser C4 until you hear the noise level rise and fall, indicating that you are tuning through resonance. Adjust the condenser C4 for the highest noise level.

Now, before you try to find the five-metre band, get some nearby five-metre amateur to go on the air for you. You can't do much good unless you have some signal to hear. Sunday evenings from 7 o'clock onwards will nearly always find a few stations on the air, anyhow.

Set your two tuning condensers, C1 and C2, about half-way in, and adjust the trimmer, C3, until you hear a station. It may be very sharp, so tune carefully. Once having hit a station, stop this adjustment, and find the station again by tuning the vernier dial on C2. Now revolve C1 until you find its peak,

indicated by a rise in noise level and nal. Your troubles are over—you ve found the band.

The final adjustment of C3 is left at setting which will allow you to tune all the five-metre stations within the l reading, which should be quite easy, ng the three-plate condenser. A two- te will probably still do this, but it is ler to start off with something up r sleeve.

f the aerial coil is coupled too closely won't get such a sharp peak on C1, keep it spaced about ¼-inch from the d coil for a start.

The unit is so sensitive that you will bably tune in signals on almost any dial. The vertical half-wave five-metre e as high as you can get it will be t for transmitters using vertical ials, as so many of them do. Stations using horizontal beams, &c., will give best strength on a horizontal receiving aerial.

We believe the minute instructions we have given, together with the diagrams, will allow anyone to get the converter working with very little trouble, if the coils are wound as we have instructed. When you know more about the converter you may be able to modify coils, &c., to get even better results—we have aimed to give you a good start.

You will probably find a number of "silent carriers" round the dial, without modulation. These are harmonics from the oscillator in your short-waver, and can't very well be avoided without careful shielding of the unit and leads to it, &c. They are not likely to bother you at all, and at least indicate that the 6K8G is oscillating.

If you like to play round with oscillator coil adjustment, use a coupling which gives you an oscillator grid current, measured by a meter in the cathode end of the grid leak (50,000 ohms) of about .15 milliamps at the lowest reading. The valve can take up to .25 milliamps without trouble.

In our next issue we hope to describe a simple two-stage transmitter, which will allow you to put a clean, steady signal on the five-mentre band to complete your station.

OSCILLATOR CONDENSERS

Since this article was written we have had more time to play about with the converter, and, as a result, have reduced the oscillator tuning condenser to two plates. This is more than enough to cover the whole band, and the three-plate, apart from the fact that it might be harder to get, will crowd the tuning more than is necessary.

A few words about last week's listening might be interesting. On the Sunday evening, which is the most active time for 5-metre stations, we turned it on. Almost straight away in came 2LZ from Wentworth Falls in what is possibly the loudest 5-metre signal we have ever heard, with the exception of 2EM, who is only a mile or two away.

For comparison we changed over to one of the super-regenerative sets we still have round the place, and again tuned to 2LZ on the same aerial. His signals were still strong, but nowhere near the same in clarity as with the converter. There was still enough background hiss to spoil them.

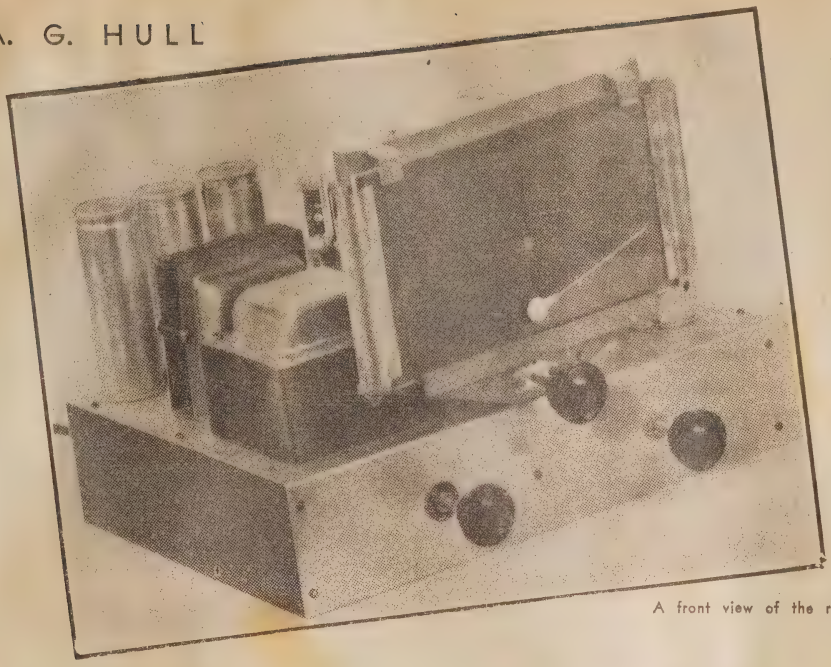
Being badly screened to the south, we rarely hear decent signals from stations over the Harbor. However, we listened round on the super-regenerative set for a couple of stations working 2LZ. Try as we might, there was nothing to be heard above the hiss.

Turning now to the converter, a little careful tuning brought to light four stations, and all except one was 100 per cent. readable. The fourth was so badly frequency modulated that he ought to be dealt with.

The point we make, however, is that signals not heard on the old set were R3-4 on the converter.

The two super-regenerative sets we have been using both have three valves with a separate quench oscillator, and are generally considered to be good ones. They are the same two which were used when we made 5-metre distance records about three years ago, records now well and truly shattered.

By A. G. HULL



A front view of the receiver.

A NEW HIGH-QUALITY SET

using positive bias detector

Here is a new circuit designed for experimenters in high-quality reception. The use of a T.R.F. tuner, new low-distortion detector, and single triode output, allow particularly high-quality reception especially from the local stations. The set has fairly good range, and will tune in many inter-Staters.

WHEN superheterodynes first started to overshadow the sets using tuned radio frequency amplification there were many complaints about the poor quality of reproduction obtained by the superhets. Careful attention to the design of intermediate transformers for superheterodynes has resulted in it becoming possible to produce superhets. with satisfactory reproduction, but, if you want to obtain exceptional tonal quality in a simple way, the sure method is to revert to the old t.r.f. circuit.

The t.r.f. circuit is not as selective as the superhet., nor so sensitive, but it is capable of giving all that is required of local reception.

In the suburban areas of the big cities, where about 80 per cent. of a.c. receivers are to be found, the main requirement is reception of the powerful local stations. Here is a set specially designed for the purpose, and designed to bring in those stations with a degree of fidelity which would be extremely difficult to obtain with even an elaborate superheterodyne.

THE TUNING CIRCUIT

The actual effective frequency response is far wider than available on any ordinary commercial receiver, with very low distortion, and ample power output for normal household requirements. The set is simple to build and particularly easy to get into perfect alignment. The cost of a kit of parts is considerably lower than for a superhet. of similar size.

The tuning circuit follows the same style as has been standard for the pa ten years, but general performance h been enhanced by the use of the late type of multi-layer coils, wound wi litz wire on Trolitul formers, and ful impregnated against the effects humidity. These coils, being design for use with superheterodynes, are f more keenly matched than the co which were used in t.r.f. circuits in t good old days. Tuning condensers a also built to a greater degree of accu acy, so that perfect tuning and alig ment become as simple as A.B.C.

THE AUDIO AMPLIFIER

The audio amplifier is simple a straightforward, but actually the res of considerable experimenting. Over period of months we have had an amp

ier of this type hitched up to a crystal pick-up for playing gramophone records, and every time we found an hour or two to spare we have changed things around a bit and carefully compared practical results with those which could be expected from theory.

Originally the 6C6 was used as a pentode audio amplifier, but we found that by running it as a triode we could notice a decided improvement in the actual reproduction, especially with the load and bias values specified.

Experiments were conducted with beam power valves in the final, with and without inverse feed-back, and we even tried the effect of using feed-back with triode output. After all this experimenting we are more than ever convinced that for true quality you

PARTS LIST

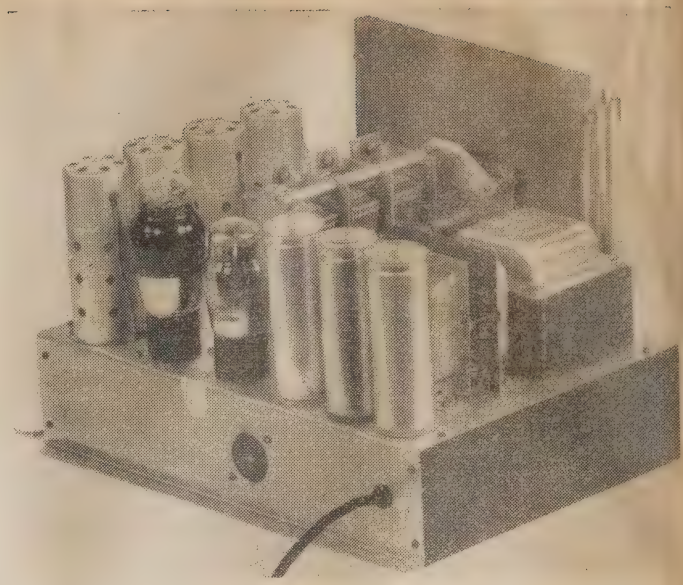
Base, size 13½ x 9½ x 2½.
Power transformer, 385 v./100 ma. 6.3 volt filaments, etc.
Filter choke, to carry 100 ma.
Set of t.r.f. coils (1 aer. 2 r.f.)
Three-gang tuning condenser.
Dial to suit.
8 mfd. electrolytic condensers.
.0001 mfd. mica condenser.
.005 mfd. mica condenser.
.1 mfd. tubular condensers.
.5 mfd. tubular condenser.
25 mfd. electrolytic condenser (25 volt).
400 ohm resistor, to carry 150 ma.
10,000 ohm 1 watt resistor.
250,000 ohm 1 watt resistors.
500,000 ohm 1 watt resistor.
500,000 ohm volume control (for tone).
10,000 ohm volume control.
15,000 ohm voltage divider.
Radio frequency choke.
Sockets (3 4-pin, 4 6-pin).
Valve cans.
Valves (2 6D6, 2 6C6, 1 6A3, 1 80).
Speaker (2500 ohm load, 1000 ohm field).

an't do better than stick to triodes hroughout, and low-gain triodes at hat.

Having eventually obtained what we onsidered the utmost performance rom a couple of triodes, we built up he tuner unit on an old base for further experimenting, and for investigating the detection problem.

At first we tried various forms of eaky-grid and power-grid detection in he 6C6 of the original amplifier, but e couldn't get any arrangement which ppeared to allow a thorough driving f the output valve with the varying ercentages of modulation found in the ocal Sydney stations.

We added a separate valve as a traight diode, with a third winding on he second r.f. transformer, but, realising that this would be a drawback, as a pecial type of coil kit would be needed, e tried a diode detector with the iode load in the cathode circuit. This orked out quite well, but in the last nglish mail we noticed an entirely ew type of positive bias detection described in that excellent English technical journal, "Wireless World." Nothing very concrete in the way of data as given, so we carried out experiments to our own satisfaction, and soon ound a most effective way of getting etection which gives a remarkable improvement in results. This can be eadily proved by operating the set in n upside-down position and applying

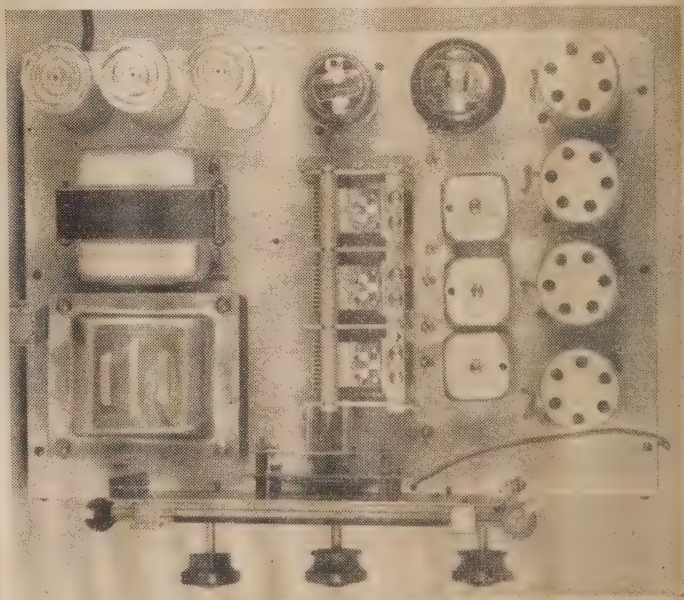


The set from the rear. The power supply is in the foreground. Two R.F. stages, detector, and first audio are in a line in the background.

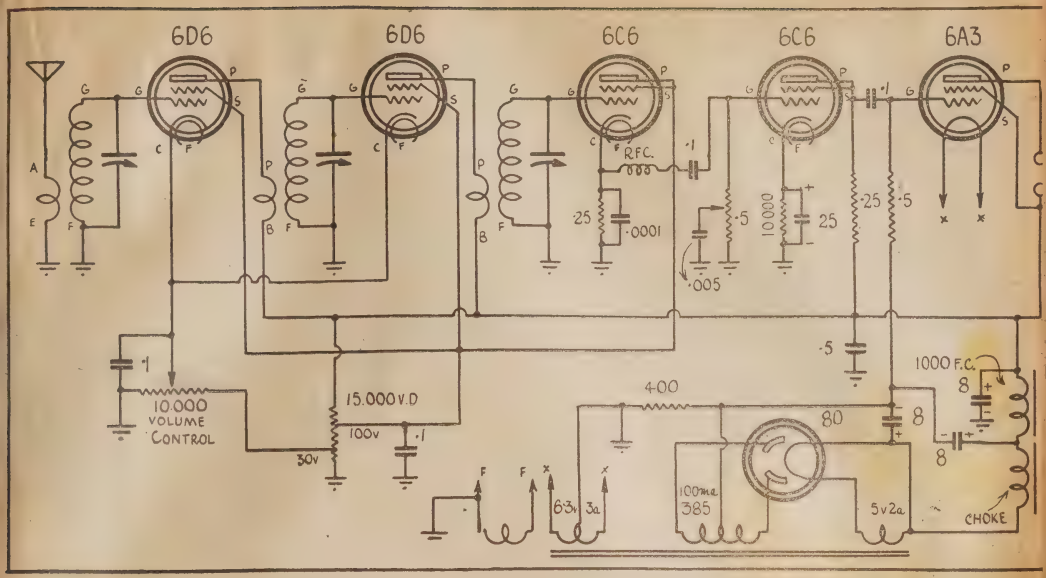
the plate voltage to the diode detector with a short piece of wire. Putting it on and off gives an astounding revelation of the deficiency of an ordinary diode detector.

The experiment aroused our enthusiasm to such an extent that we hastened to build up the whole circuit into a compact unit, and that's the set you see in the photographs!

Maybe that's a long way of telling the story, but it is very evident that the average reader of "Radio and Hobbies" has a keen appreciation of technicalities, and so we have gone to some length to explain how it all came about. Those



The set from above, illustrating the layout on the chassis. Not at all critical to fractions of an inch. Don't forget to insulate those first two electrolytics!



The circuit of the new set. Note the connections to the detector.

not so interested in the theory can take our word for it that the set is one which will give results from local stations which are jumps ahead of what is expected from an ordinary cheap set.

If anyone can suggest any way of getting greater fidelity from standard valve types we'd like to hear about it.

CONSTRUCTION

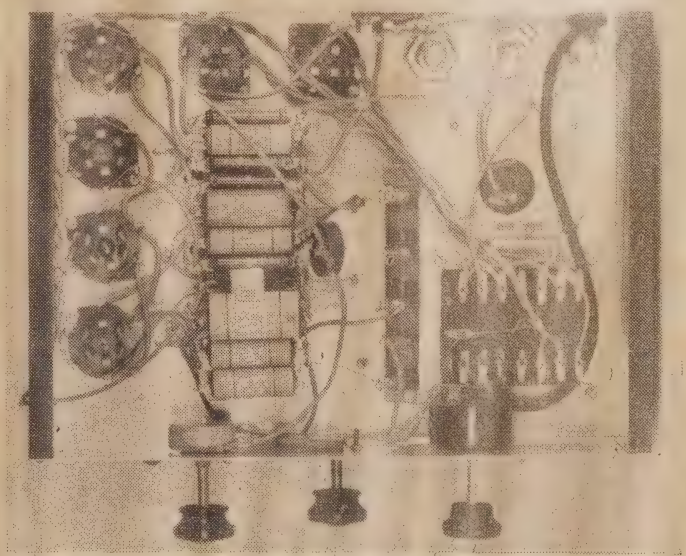
But to get on with the job of building up a similar set. The first thing needed is a kit of parts, and we show in this article a complete list of the "bits," also the actual brands of the parts used in our set. If you think it will make the building any easier or the photographs and diagrams any easier to follow, you can get a kit of exactly the same type and style of parts. You'll find that, as usual, we have played safe in selecting high quality parts, with ample tolerance in ratings. It pays in the long run!

THE BASE

The original base measured 9½ x 13½ x 2½, and we doubt if it would be at all easy to use one any smaller. Being "the Sturdy Pioneer," we had to get a piece of aluminium folded to size, and then cut all the holes required, using a wood-bit for the valve socket holes by lubricating the cutting with a little sewing machine oil. The big hole for the power transformer was cut with a fine-toothed hacksaw blade, after drilling half a dozen eighth-inch holes in each corner to get started, the holes being nipped together into a slot with the angl cutter pliers.

When we cut the holes for the electr lytic condensers we forgot to allo clearance for the two which need to insulated. A few minutes with a rou round file solved the problem, and only mention it in case you mig happen to fall into the same trap. Tho who wish to avoid strenuous effort w take the easy way out—ordering a rea cut and drilled base from the rad dealer who su plies the rest the kit of par thereby avoiding lot of work a worry, and ma ing quite sure th an error of layo is impossible.

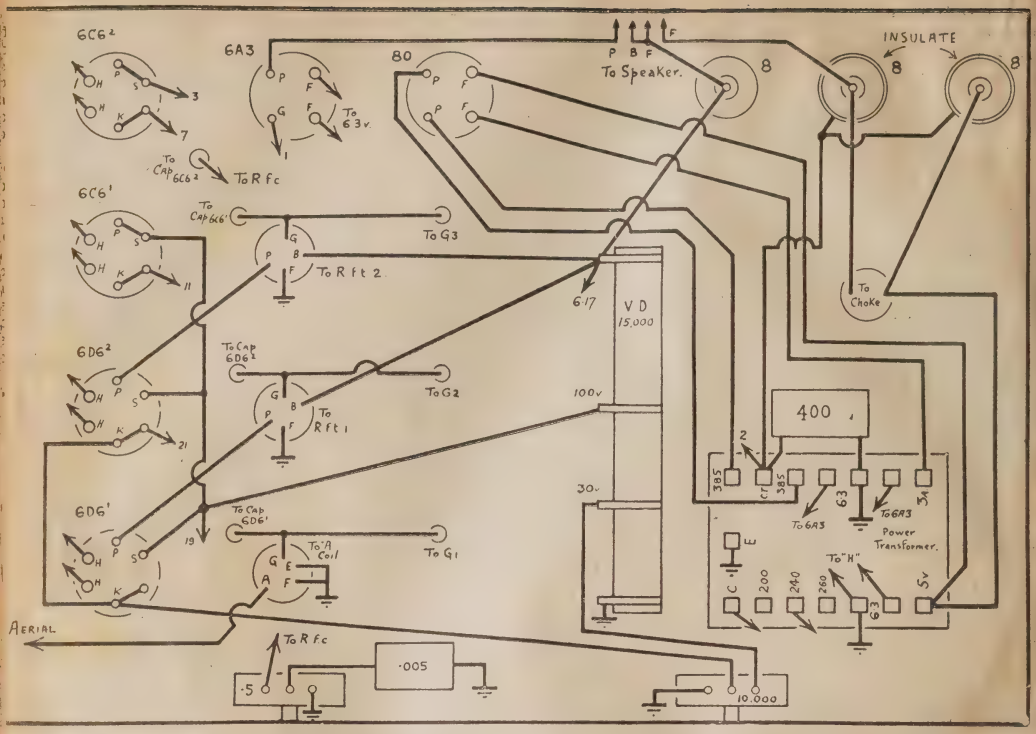
A ready c base will ha ample rigidity, b with an al minium one it our practice to ends of woo which strength it up a lot.



Under the chassis. Connections to components on the panel are shown on a separate diagram.

ASSEMBLY

Assembly simple enoug especially if y use a dial of t type as sho in the phot graphs. Th dial moun directly to t end of the ga condenser wi two screws a spacing washe Incidentally, suggest that t



The wiring diagram, drawn to scale. It is very simple. Numbers coincide with the respective components on the terminal strip.

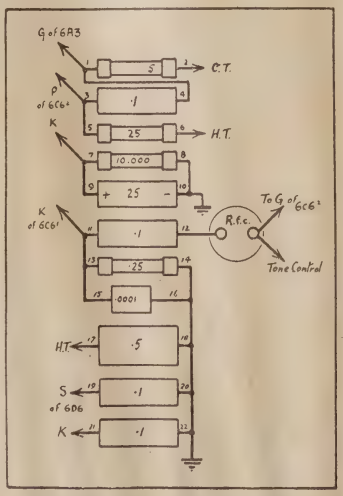
ower transformer, choke, electro-tic condenser, and sockets are rst mounted and completely wired efore the gang and dial are mounted.

VIRING

The wiring is done in two distinctly parate steps, and this makes it very mple. First of all the chassis is sembled and wired up to correspond ith the picture diagram, short lengths wire being left as indicated by the rows. Then a strip of bakelite (ready it strips with terminal lugs mounted e available at all dealers) is loaded up ith the minor resistors and condensers, ounted in position, and then the con-ecting up of the loose ends completes e job. There is no above-panel wiring cept where leads run through from nderneath, for the caps of the valves the tuning condenser.

RECAUTION

Care must be taken with the power pply lead, which should consist of eavy power flex, with a rubber grom-et to prevent the insulation from tear-g where the wire runs through the etal of the base. A knot should be ed on the inside so that no pull on e flex will impose a strain on the ldered joints to the terminal strip of e power transformer. Always remem-er that these terminals are very dan-erous, and should not be touched while e set is in operation. Normally the t sits upright and is quite shock-proof, but we mention the precaution in case you feel inclined to try the test of the diode plate, voltage along the lines we mentioned earlier.



The terminal strip. Wire the components first, then make the connections as shown. Finally, mount on two long bolts and connect into circuit according to the numbered leads.

THE AERIAL LEAD

We suggest taking the aerial wire out sideways through the end of the base, rather than running it back and interweaving it with wiring attached to other coils, as such a practice is sure to lead to instability. The amplifier signals, under such circumstances, can easily feed back into the aerial circuit for reamplification, and cause a loud squeal before the sensitivity of the set reaches normal.

It will be noted that although not very neat we use a wire instead of an aerial terminal.

OPERATION

After you finish the wiring you should make thorough inspection, watching out for odd splashes of solder, which may cause short-circuits, and for general mistakes, which can happen even in the best-regulated families.

When quite sure that everything is in order the valves can be fitted in their proper sockets, and the speaker plugged in. On no account switch on the power until the speaker IS plugged in. Attaching a suitable aerial and rotating the dial should bring in the stations in a way which will give you the thrill of your life!

GETTING RESULTS

Building a set of this kind and get-

ting it performing doesn't mean "finis," however. For example, it is a shame to see a set of such latent performance fitted in a cheap cabinet full of resonances. Correct performance can only be obtained if the speaker is mounted on a suitable baffle board. We suggest nothing less than three feet square, and of inch-thick celotex, or at least three-quarter inch thick pine.

Room acoustics are the next point to be studied. Don't put the baffle flat against a wall and don't mount in longways in a narrow hall or anything like that. For preference have it across a corner, but well out from the corner, and facing out into a clear room.

Heavy carpets, curtains and cushions can absorb some of the brilliance, although the actual degree with which the high notes should be reproduced for good "tone" is rather a matter for personal opinion. We like the reproduction crisp and clear.

ALIGNMENT

Tuning in a station about the middle of the dial, backing off the volume control until the set is operating at a whisper, and then setting the trimmers on the gang condenser to give best results, is all that is required in the way of alignment.

FOR GRAMO. WORK

The audio end of the set makes an ideal amplifier for the reproduction of gramophone records, but only when a crystal pick-up is used, as otherwise the gain is low. With the average crystal pick-up, however, the gain is just right and full power output can be obtained quite readily.

BRANDS

For the benefit of those who want to use exactly the same type and brand of components as shown in the photographs we give the following list, but we would point out that equally suitable components are also available in other brands.

Power transformer, Henderson; filter condenser, Solar; coils, R.C.S.; tuning condenser, Stromberg-Carlson; dial, Efco; choke, Radiokes; volume control, Marquis; tone control, Yaxley; tubular condenser, Ducon; mica condensers, T.C.C.; resistors, Bradley.

A MIKE TRANSFORMER

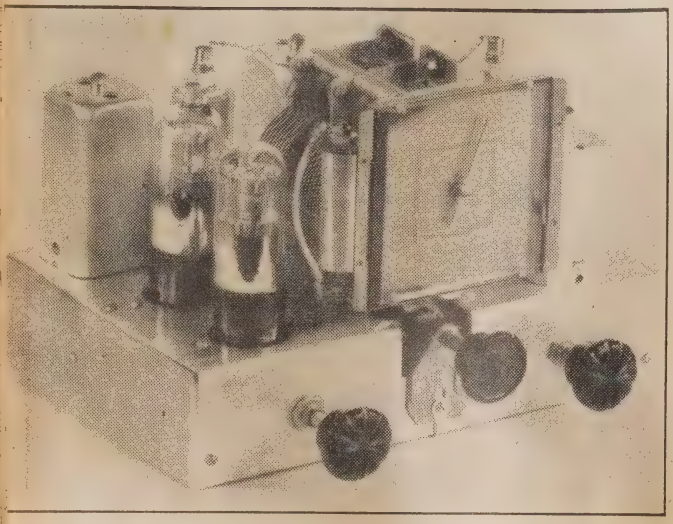
WHERE a mike transformer is needed in a hurry, one can be made by winding a new primary on an audio transformer.

Remove the transformer from the case and cut off the primary leads. This winding is not used. Wind directly over the secondary winding, one layer of about 32 gauge enamelled copper wire.

Solder new leads to the new primary; replace transformer in case, and connect the leads in the usual way. This completes an efficient mike transformer.

The R. & H. PORTABLE

4-valve receiver



The chassis from the front. The valve in the foreground is the 1C5G output pentode, with 240 milliwatts to its credit. Volume control to the right. A piece is cut off the front plate of the dial to make it flush with the bottom edge of the chassis.

Here is the Portable Set of the year! A jump ahead of everything! Four-valve circuit with high performance coils gives marvellous gain. Illuminated tuning dial! Special collapsible aerial provides extra signal pick-up! Special Rola speaker gives finest tone and volume. In the home, in the country, in the car, this receiver is the highlight of the season!

By JOHN MOYLE

AT the present time the radio trade is definitely portable-set minded. Pretty well every factory is hard at work on the production of a attery set in a carrying case.

Some of these sets have already been eleased. Others are just about to intro- uce themselves in anticipation of the pring and summer demand.

So, not to be left out of it, we have one a bit of quick work, and built up portable receiver for ourselves.

HE NEW VALVES

In the past we haven't put much faith portable sets. Not that they wouldn't ork well—there is little more in build- g a good portable than in making any ther kind of set. But the batteries!

To begin with, one was practically rced to use 2-volt valves. Now, al- ough battery makers can do wonders producing compact accumulators, ere are definite limitations in this gard which cannot be obviated. And ith 2-volt valves, working at their full tings, an accumulator is about the nly satisfactory way of getting 2 volts.

Then again, there is the weight of such accumulator, the danger of spilling it, and the effect on the receiver of the fumes it gives off.

In the matter of B batteries, the least equipment required was three 45-volt B batteries and a C battery.

So that, by the time our set was finished, we had totalled up a pretty little problem in batteries. Result—only the very enthusiastic worried about portable sets.

USE IT IN YOUR CAR!

This receiver makes an excellent car set, and we have been using it as such ever since it was built. Its great advantage is that it can be taken out of the car, for picnics, &c. Whereas a standard car radio is fixed, and cannot be moved.

Now the introduction of the new 1.4 volt valves has changed everything.

These valves have been specifically designed for dry-cell operation. They are remarkably efficient in many ways. A single dry-cell battery is all one requires for the filaments, and because the drain is very low (.07 amps for all but the output valve, which takes .1—a total of .31 amps) a single dry cell of the standard type will last quite long enough to make it practicable in a portable.

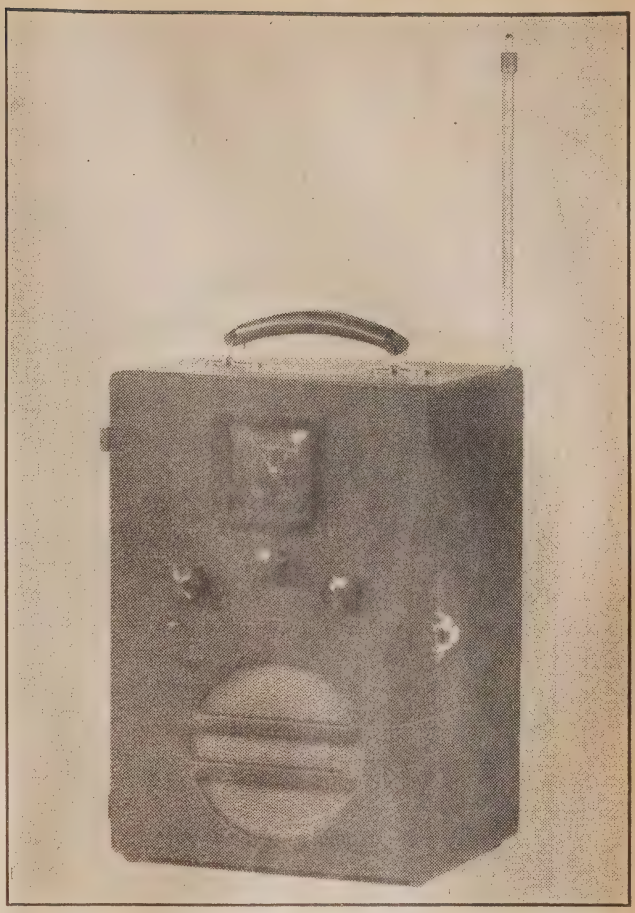
Better still, the voltage required to give full performance is only 90 volts. Thus we have eliminated one of the 45-volt batteries, and are now down to two 45-volt light duty types.

These batteries may be packed into a cabinet, with nothing to spill or cause trouble, and completely forgotten until poor signals indicate that a renewal is required.

Performance suffers very little on the broadcast band by the use of these valves against the 2-volt types. 240 milliwatts is obtainable from the output pentode, which, when used with a good speaker, is enough for any ordinary person.

All these points, taken together, represent our reasons for making up this portable set. Now let us tell you something about it.

The cabinet with the lid removed. Note the collapsible aerial rod, which can be cut flush with the cabinet if required. Ours was in handsome red imitation leather. The dial may be illuminated



OUR CIRCUIT

The receiver described here is a 4-valve type, very similar to the Pentagrid Four receivers of the past. It is simple, effective, and foolproof.

A portable set presupposes that one will be getting the most from the least apparatus. Many people in the past have held that five valves are required for a good portable receiver. Some still do. Our experience with 4-valve sets has led us to the belief that for good local reception on a small aerial, and good general reception on a wire strung over the limb of a tree, four valves will do the job.

Now listen to the reasons why. With the set described here, using about 2ft. of aerial, we have at night tuned in 2CA, Canberra, at first-class speaker strength, while hosts of the small stations at the bottom of the dial, and the bigger regionals, were also audible.

On an outside aerial, there appeared to be nothing we couldn't tune in. In the daytime several regionals were tunable, plus Newcastle and equivalent stations.

If we had been using a 5-valve set we don't think there would have been anything to it.

On this same 2ft. of aerial, all the locals were easily tunable at good strength anywhere in Sydney. In fact, this is the first set with which we remember tuning in all the local stations on such a small aerial, right inside the steel-framed building housing the offices of "Radio and Hobbies."

A five-valve receiver would have meant one extra valve, a more expensive condenser and coil kit, and possibly more space in the cabinet. We couldn't see the extra expense was justified.

AS A CAR RECEIVER

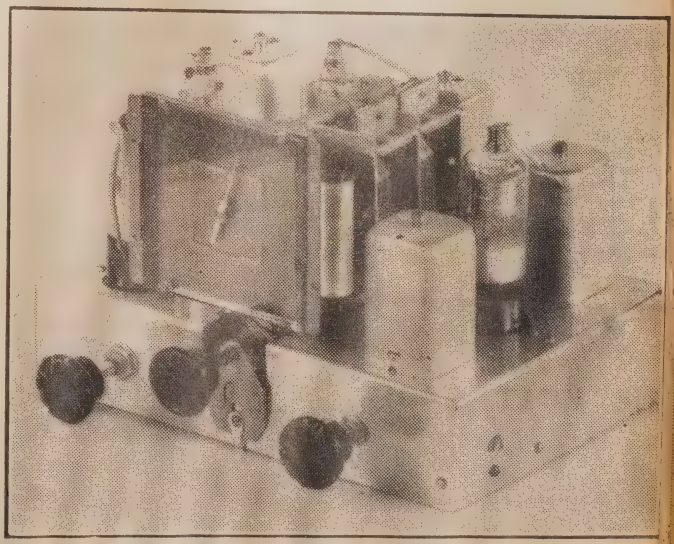
One of the happiest features of this new portable is its success used as a car radio.

At the present time we are using a vertical steel aerial mast, about 6ft. high, attached to the rear bumper bar of the car.

This is connected to the receiver through a lead-in wire, the receiver itself standing on the front seat.

We have driven the car about 100 miles round the suburbs, and have been delighted with the tone and volume on all stations. So far we haven't had a chance to take the set very far afield.

We have, however, turned round the dial, with the car standing in the road outside the front gate. At night-time, about 8 p.m., recognisable signals were



Another view of the chassis. This shows the tuning coils, with the oscillator coil to the front of the chassis. Then comes the 1A7G, and then the aerial coil. The padder adjustment is through the chassis at the extreme front end.

Popular!

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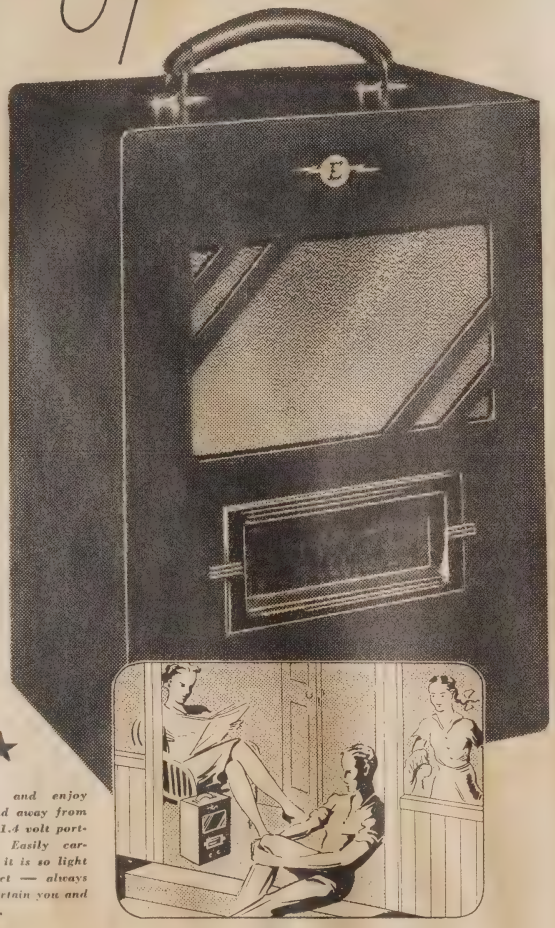

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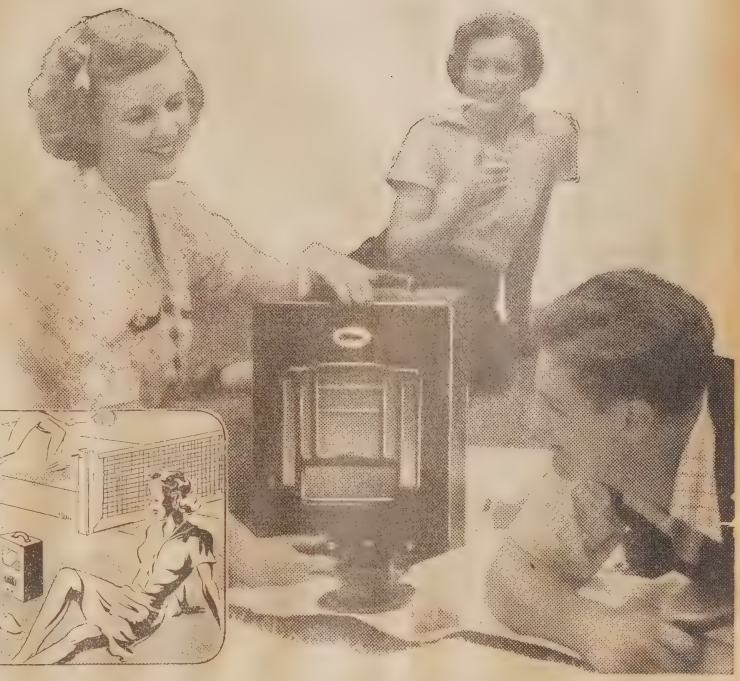

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R.C.S. TROLITUL TUNING COILS

R.C.S. new Trolitul Tuning Coils are highest Q. yet produced. Being wound on and suported by a combined Trolitul former and base, they lend themselves to an accuracy and precision hitherto unobtainable, resulting in highest efficiency ever obtained. All coils are suitable for standard type valves.

R.C.S. Trolitul Broadcast Coils

Air Core Aerial Coils, 460 K.C. Cat. No. E282. Retail Price, 5/9 ea.

Air Core R.F. Coils, 460 K.C. Cat. No. E283. Retail Price, 5/9 ea.

Air Core Oscillator Coils, 460 K.C. Cat. No. E284. Retail Price, 5/9 ea.

Iron Core Aerial Coil, 460 K.C. Cat. No. E287. Retail Price, 7/- ea.

Iron Core R.F. Coils, 460 K.C. Cat. No. E288. Retail Price, 7/- ea.

Iron Core Oscillator Coil, 460 K.C. Cat. No. 289. Retail Price, 7/- ea.

Permeability Tuned Aerial Coil, 460 K.C. Cat. No. E279. Retail Price, 7/6 ea.

Permeability Tuned R.F. Coil, 460 K.C. Cat. No. E280. Retail Price, 7/6 ea.

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FOR THE R. & H. PORTABLE

R.C.S. Trolitul Coils, because of their special design and small physical dimensions, make possible easy assembly and attainment of results heretofore impossible in a portable. High quality, selectivity, and sensitivity under all conditions are assured.

R. & H. PORTABLE COIL KIT, CAT. No. K103, PRICE, RETAIL, 29/6.

FOR THE NEW HIGH QUALITY RECEIVER

Specify R.C.S. Trolitul High Q. Coils. Their efficiency is a large contributing factor to the very good quality reproduction of this set. Order Cat. No. K101 COIL KIT (3 COILS). RETAIL PRICE, 18/3.

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R.C.S. Plug-in Coils for the Duplex Single and other Circuits are ideal. B/C Band, 16 to 50 and 40 to 120 metres coils. Cat. No. K48. RETAIL PRICE, 5/9 each.

THE LITTLE JIM

This is the most popular set for beginners and others, too. LITTLE JIMS COIL, CAT. No. K80. PRICE, 3/6, Post Paid. LITTLE JIMS R.F. CHOKE, CAT. No. RF2. PRICE 1/- Post Paid LITTLE JIMS MIDGET CONDENSER, CAT. No. CV40. PRICE, 5/3, Post Paid.

TROLITUL MIDGET CONDENSERS

R.C.S. Midget Condensers are made in two types, using Trolitul supports, thus guaranteeing practically no loss. The 14-plate equals old style 23-plate capacity. The M.C. type may be ganged.

DUAL WAVE UNIT

B/C 1500 to 550 K.C. S/W 16 to 50 Metres.

Aerial, R.F., and Oscillator 460 K.C. A.C. Cat. No. DW24. Retail Price, £3/3/-.

Aerial, R.F., and Oscillator 460 K.C. Battery. Cat. No. DW25. Retail Price, £3/3/-.

DUAL WAVE COILS

B/C 1500 to 550 K.C. S.W. 16 to 50 metres.

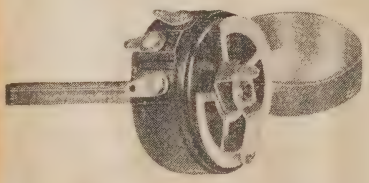
Air Core Aerial Coil, 460 K.C. Cat. No. G19. Retail Price, 12/6.

Air Core R.F. Coil, 460 K.C. Cat. No. G20. Retail Price, 12/6.

Air Core Oscillator Coil, 460 K.C. Cat. No. G21. Retail Price, 12/6.

STAR AND M.C. MIDGETS

Max Cap. mmfds.	Min. Cap. mmfds.	Cap. Plates.	STAR Cat. No.	Price.	M.C. Cat. No.	Retail Price.
10	3	2	CV34	3/-	CV41	6/-
15	3	3	CV35	3/3	CV42	6/6
25	3.5	4	CV36	3/6	CV43	7/-
25	4	5	CV37	3/9	CV44	7/6
50	4	7	CV38	4/3	CV45	8/-
70	5	9	CV39	4/9	CV46	8/6
100	6	11	CV40	5/3	CV47	9/-



Obtainable from your local dealer, or write direct to

POTENTIOMETERS AND RHEOSTATS

The R.C.S. Volume Controls are the result of improved and new methods of manufacture, together with alterations in design and final testing, Noiseless, they are constructed so as to cut off all volume.

6 ohm	Rheostat	.25 Amp.	Cat. No.	PT40	4/6
10 ,,	,,	.25 Amp.	,, ,,	PT38	4/6
20 ,,	,,	.25 Amp.	,, ,,	PT39	4/6
30 ,,	,,	.25 Amp.	,, ,,	PT34	4/6
400 ,,	Potentiometer	50 M/A	,, ,,	PT46	4/6
1000 ,,	,,	35 M/A	,, ,,	PT47	4/6
2500 ,,	,,	30 M/A	,, ,,	PT49	4/6
5000 ,,	,,	30 M/A	,, ,,	PT51	4/6
10000 ,,	,,	20 M/A	,, ,,	PT52	4/6
15000 ,,	,,	20 M/A	,, ,,	PT53	5/9
20000 ,,	,,	15 M/A	,, ,,	PT54	6/-

R.C.S. RADIO PTY. LTD.,

50 GLEBE STREET, GLEBE. 'Phone, MW2405.

Air Core, 1st, 460 K.C., sq. can, 3in. x 1⅝in. Cat. No. IF107. Retail Price, 10/6.

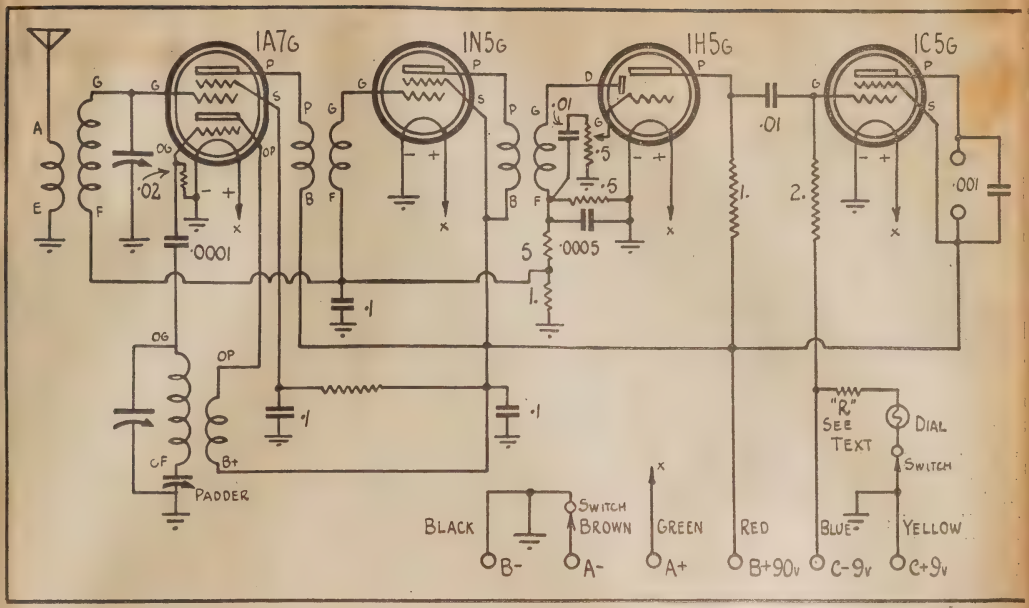
Air Core, 2nd, 460 K.C., sq. can, 3in. x 1⅝in. Cat. No. IF108. Retail Price, 10/6.

Iron Core, 1st, 460 K.C., sq. can, 3in. x 1¾in. Cat. No. IF109. Retail Price, 10/6.

Iron Core, 2nd, 460 K.C., sq. can., 3in. x 1¾in. Cat. No. IF110. Retail Price, 10/6.

TROLITUL INTERMEDIATE TRANSFORMERS

The new R.C.S. Trolitul I.F.'s are extremely stable, due to new method of construction, made possible by the use of Trolitul formers and base. No loose wires to shift and alter frequency. Positively the best I.F.'s yet produced.



Here is the circuit. Note the special circuit for A.V.C., which improves sensitivity and general control. Very few parts are required for the set.

obtained from 51 stations in Australia!

More than half of these would have a programme value.

With the aerial we have mentioned, practically no ignition interference could be noticed when tuned to a station. Only when a signal happened to drop right down when passing a badly shielded object, could it be heard above the swish of the sedan car. Volume and tone have been remarked on by all who have heard the set, and been fascinated by it.

THE AERIAL

Before we pass on to a description of the very simple circuit, we propose to say something about the problems of portable design, and how we tackled them.

One of the first things any portable set designer must consider is the matter of an aerial. To date, the "loop" aerial wound in the lid, has been considered the thing.

However, this type of aerial has many decided disadvantages.

In the first place, its pick-up is limited. It is granted, of course, that if you want the best performance, whether in the home, or on the road, the best idea is to sling a length of wire over the limb of a tree, and use a regular aerial.

Therefore, our maximum results are well taken care of in the normal manner.

But when this isn't possible, or desirable, as, for instance, when operating the set within about a 25 air-line miles radius, a built-in aerial is a great convenience. The loop isn't too bad, but we have found a better one. In addition, it isn't as directional as the loop aerial, which must be pointed for best results from any particular station, and prevents the lid from being taken off the set, as is often desirable.

After considerable experiment, we found that a collapsible rod aerial, which can be pulled up from the cabinet, and pushed back again when not required, is quite the best of them. It represents the 2ft. aerial of which we have been speaking.

In our set we used a collapsible aerial in two sections, each of which is 2ft. long. This means that when collapsed, it projects from the cabinet for about 9 inches, but we don't find this inconvenient. It allows us to employ a 4ft. rod when fully extended, and you can take our word for it, this extra length is well worth while.

If you can manufacture one of three sections, so much the better. It is just a matter of obtaining the required two sections of tubing, one fitting into the other, with a rod running through the centre.

A quick and easy make-shift we found was an ordinary curtain rod, cut down to size. The tube runs through a hole in the top corner of the cabinet and is fastened at the bottom with a tack so it won't pull out.

Our present aerial is made of duralumin, and was stolen from a section of a 5-metre collapsible aerial. It has a tapered collar which pushes over the end of the tube (which has a slot cut one inch from the top) to lock the rod in place when extended. A nut fastened to the bottom of the tubing takes a bolt run through the bottom of the cabinet, to keep the rod firmly in place.

The whole makes an ideal aerial, and W. J. McLellan can supply such a tube if requested.

However, you can easily experiment with loop aerials if you desire by winding about 40ft. of wire inside the lid. The lid also has a removable plate inside it. Behind this plate you can fix a plate of aluminium or tin, to take the place of the loop. Connection into the cabinet may be made through one of the hinges, to avoid trailing wires.

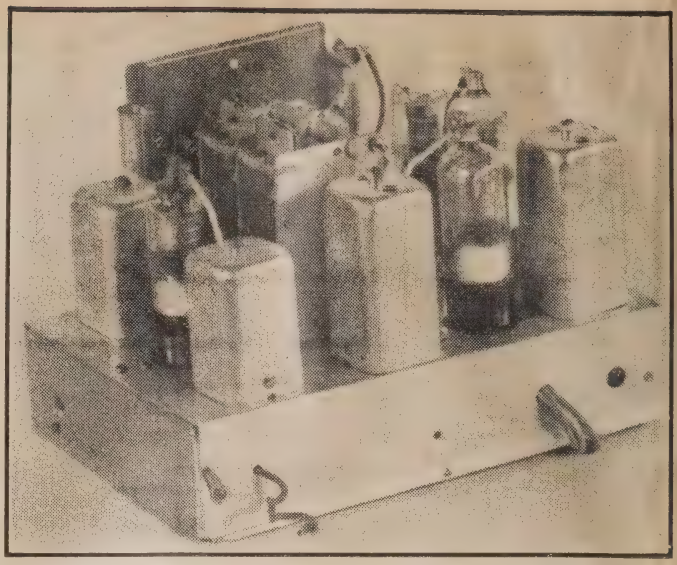
However, you will find the rod aerial quite the best idea, and, as far as we know, it is the first time the idea has been applied to a portable receiver.

PARTS LIST

1 Base, 9 x 7 x 2.
1 Small tuning dial.
1 465 kc. coil kit (b'cast).
1 2-Gang condenser with trimmers.
1 .5 meg. potentiometer and switch.
1 5 meg. resistor.
1 2 meg. resistor.
2 1 meg. resistors.
2 .5 meg. resistors.
1 .02 meg. resistor.
2 50,000 ohms resistor.
½ watt.
3 .1 mfds. tubular condensers.
2 .01 mfds. mica condensers.
1 .001 mfds. mica condenser.
1 .0005 mfds. mica condenser.
1 .0001 mfds. mica condenser.
Sockets—4 octal.
Valves—1A7G, 1N5G, 1H5G, 1C5G.
Batteries—2 45-volt light duty type. One or two standard 1.5-volt cells. 9-volt C battery.
Hook-up wire, nuts and bolts, solder, &c.
Cabinet—See article.

THE CABINET

The problem of obtaining a good cabinet for a portable is probably the next



A rear view of the set. The lead at the left foreground is the aerial wire.

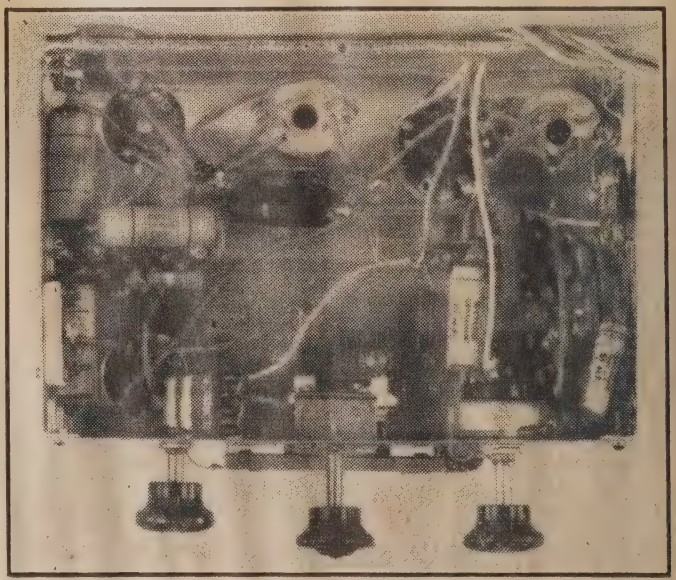
thing you will want solved. So we have contacted a well-known maker of such cabinets, and he has produced one to fit this receiver, ready cut for the dial, control shafts, and rod aerial. You simply push the set into position, screw in the speaker, and pack in the batteries. It is a handsome cabinet, and will make your set every bit as attractive as any commercial receiver.

Our cabinet was made by the Western Manufacturing Co., of Five Dock.

THE SPEAKER

One of the mistakes one can make with a portable is to use too small a speaker. Many sets use a little 4-inch model, so that it can be mounted on the

(Continued on Page 46)



This photograph shows how the parts are arranged under the chassis. A special Trolut Trolitul coil kit is used, although standard coils will work quite well. Note padder screwed to the chassis at the bottom left-hand edge.

BRIMAR VALVES ARE THE HEART OF THE R&H PORTABLE!

HOME BUILT PORTABLE RECEIVERS AT LAST MADE PRACTICABLE BY THE INTRODUCTION OF 1.4 VOLT VALVES!

Up till recently the construction of home built portables was something to be avoided . . . cumbersome accumulators had to be installed and kept upright in case the acid spilled. Then again, fumes from the acid played havoc with the fittings and the interiors of the portable cabinets. Heavy batteries were also necessary, which made the so-called portable a very hefty proposition to carry about.

With the introduction of the Brimar 1.4 Volt Valves comes a new era in portable radio history. These valves eliminate the use of accumulators! . . . and reduce by one-third the weight of batteries!

As finely built as a watch

This composite picture showing the many intricate parts required in the construction of a Brimar Valve indicates how essential is the need for reliability in the modern valve. The assembly of these parts to make the complete valve is the task of skilled operatives, hundreds of whom are engaged in the giant Brimar British Valve factory where valves are produced for use in every part of the world.

BRIMAR VALVES INSTALLED IN "QUEEN MARY" AND "QUEEN ELIZABETH"

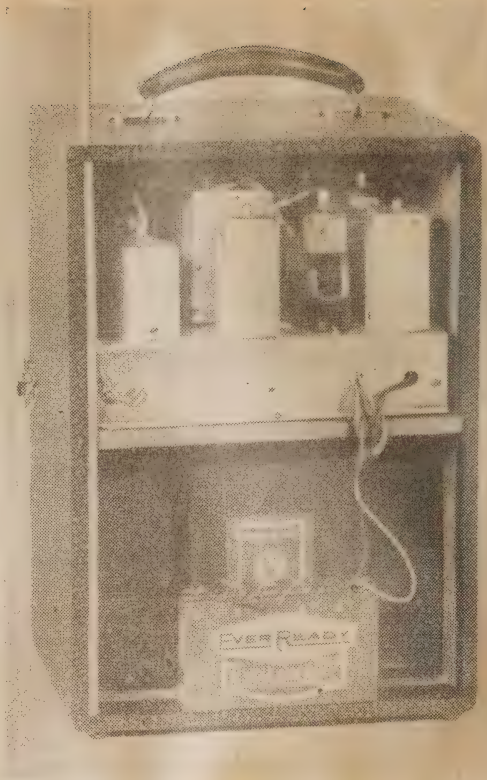
The safety of thousands of passengers carried on these mammoth liners costing £12,000,000 is dependent upon radio communication. It is significant that Brimar Valves are used in the radio installations of these ships.

Whether you construct the R. & H. portable or any other circuit you will find that you, too, can rely on Brimar Valves to give the best in range and tone.

BRIMAR VALVES

BRIMAR DISTRIBUTORS LISTED BELOW:

N.S.W.: Standard Telephones & Cables Pty., Ltd., 258-274 Botany-road, Alexandria. QUEENSLAND: Trackson Bros. Pty. Ltd., 157-9 Elizabeth-street, Brisbane. SOUTH AUSTRALIA: Radio Wholesalers Ltd., 31 Rundle-street, Adelaide. WESTERN AUSTRALIA: M. J. Bateman, Ltd., 12 Milligan-street, Perth. VICTORIA: Noyes Bros. (Melb.) Pty. Ltd., 597-603 Lonsdale-street, Melbourne. TASMANIA: W. & G. Genders Pty., Ltd., 69 Liverpool-street, Hobart; 53 Cameron-street, Launceston, also at Burnie. NEW ZEALAND: Standard Telephones & Cables Pty. Ltd., P.O. Box 638 Wellington, P.O. Box 1897 Auckland; P.O. Box 983 Christchurch.



How the new Ever-Ready batteries are packed. Two units fit each side of the speaker, and the third behind it, and between the first two. The "C" battery will be flat up against the cabinet back. Ordinary light-duty batteries will fit this cabinet just as easily, with the "C" battery at the side of them. Note the aerial tube at the left-hand side.

chassis or crammed into a tiny cabinet. This is poor practice, as the efficiency of the 6-inch type is so much better, and the small speaker simply ruins tone and volume. So we have specified a Rola 6-14 speaker for this set, and our results are guaranteed only if such a speaker is used.

These are the points which make or mar the finished job.

THE DIAL

One further feature of this set is the use of a decent dial. There is no reason why the dial on a portable shouldn't be just as good as one on a big set. This Efco model we have used is an edge-lit type, and by using two 60 milliamps. 6 volts globes in series and connected across the 9 volt C battery, good illumination is obtained for easy tuning anywhere.

A switch is fitted to turn the lights off when not required, otherwise you will be repeatedly renewing the C battery. We don't know of any other portable set with this feature.

SIZE OF THE SET

Applying our principle of common sense and simplicity, we don't make any attempts to squeeze the set into the smallest possible cabinet. There are few, if any, sets which are smaller, but we simply decided what we wanted to use and built the cabinet round the whole. Using a 6-inch speaker and the special batteries now produced for portable work, one is limited in battery space to certain dimensions. The receiver is perfectly standard in layout, except that it is slightly smaller than we usually build such sets.

The total size of the cabinet, therefore, without the lid, is only 15 inches high, 10 inches wide, and 7½ inches deep.

This is small enough to pack easily anywhere and not small enough to be easily upset or damaged simply because it is small. Shape and weight are the most important things in a portable, and an inch or two either way doesn't really matter.

Altogether, we are pleased and enthusiastic about this set, because we know you can't fail to get first-class results from it and because it has just those few features which make it different from any other.

THE CIRCUIT

Now for the circuit. This is almost the same as the Pentagrid set we described in the last Christmas issue of "Wireless Weekly," and which has proved so satisfactory.

It uses a standard 465 kc coil kit of the latest Trolitul type, to give highest possible efficiency.

The converter valve is the 1A7G.

There is one stage of intermediate amplification, and for this we used the 1N5G.

The second detector, the 1H5G, is resistance coupled to the output pentode, the 1C5G.

There is nothing much to say about the pentagrid converter, and its circuit is standard. The coils have been designed to work well with the small aerial, and should be specified if you buy a new set for the job.

The tuning condenser is a standard two-gang with trimmers, obtainable anywhere.

The I.F. stage is also used with a standard circuit.

The second detector presents one or two problems, because there is only one diode plate in it.

Therefore, we must use an A.V.C. circuit hitched to one end of the load resistor.

Now, these valves don't show up their best with the full voltage developed across the diode, applied to the grids for A.V.C. On strong stations distortion is apt to creep in owing to the first two valves being controlled too much.

Also on a small aerial we want to preserve sensitivity as much as possible, and full A.V.C. would work against this.

You will notice, therefore, that we have thrown a voltage divider from the diode load to earth, consisting of a 5 meg resistor in series with a 1 meg resistor. Thus, only portion of the rectified voltage is used for control. The high total resistance of 6 megohms is required to avoid partially short-circuiting valuable audio voltage from the diode plate.

This circuit is being adopted now as standard on the best portables of this type, and we recommend it for use with all sets operating with 1.4 volt valves.

You can, if you like, experiment with the values of these resistors, to get a control you like best. However, our values will be found about right.

You will notice, also, a high value of plate resistor for the 1H5G to get the best gain, and also a 2 meg resistor in the grid circuit of the output valve. Some even use 5 megs here, but we prefer the lower value.

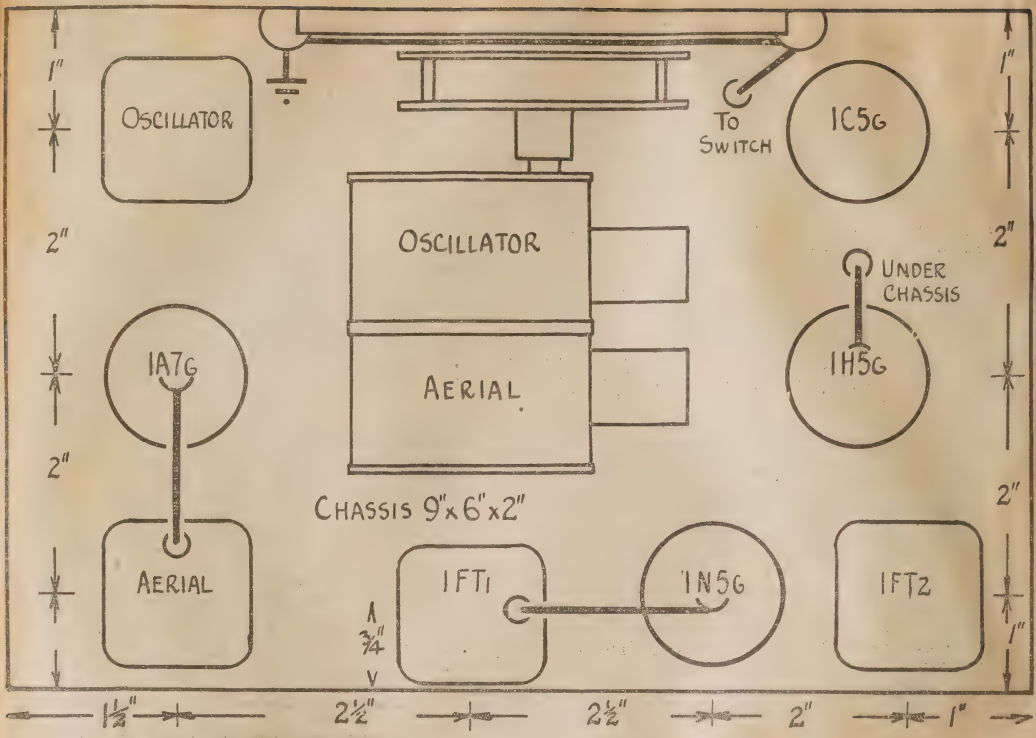
DIAL LIGHTS

The circuit shows the dial lights wired, with one globe and a resistor. This latter was originally designed to reduce the voltage on the globe to 6 volts, but we have since found that two in series is a better scheme, and makes the most of the current drawn. So regard resistor R as the second globe. And DON'T forget to turn off the switch after you have tuned in.

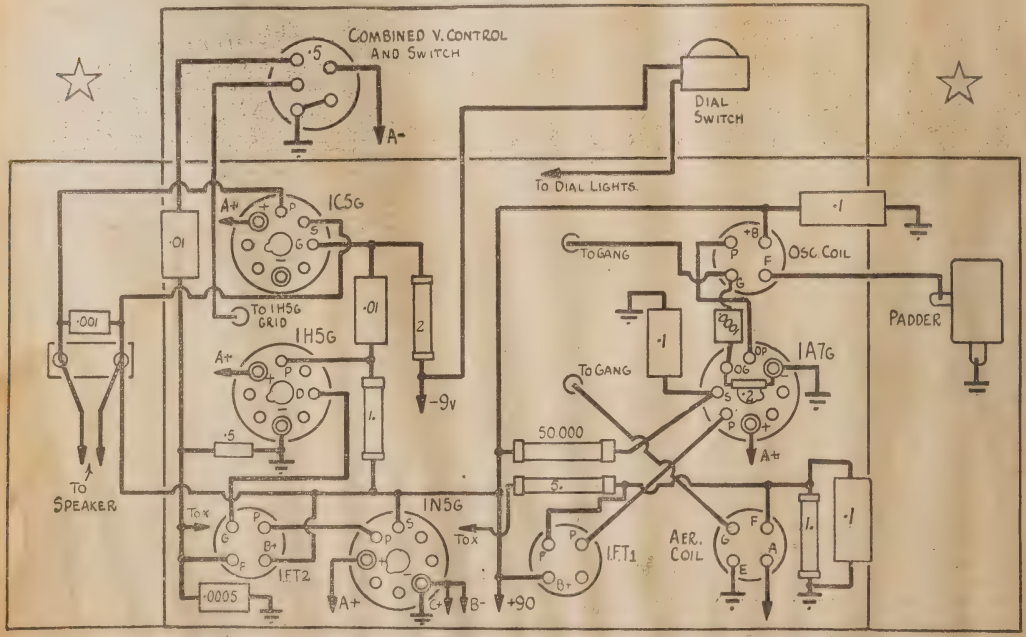
The volume control is of the type using a filament switch mounted on the back, so that the one control performs two functions. If a plain .5 meg pot is used you can omit the dial light switch, and wire the filament switch in its place.

The use of a .2 meg resistor in the oscillator grid circuit isn't a mistake—it's the recommended value. The 1H5G is a zero bias valve, and needs no bias applied to the grid. The volume control, therefore, is returned direct to the chassis.

No advantage was found when the first two valves were shielded, so we left the cans in the junk box.



The essential measurements of the chassis are given in this diagram, which is drawn to scale.



Here is the wiring diagram. The battery leads, indicated by arrow heads, pass through a hole in the rear of the chassis.

(Continued from Page 47)

ASSEMBLY

The assembly of the set is simplicity itself. The parts are few, and our wiring diagram shows them all in place. Although the chassis is smaller than usual, there is plenty of room to get everything well in place, without crowding.

Having made up the set, you will need to line it. Connect the A battery first, and see that the filaments light, before connecting any others. Next, hitch up the C battery, and finally, the B batteries.

On turning on the set, you should quickly pick up a local station, using an outside aerial. With the padder (which is mounted at the side of the chassis) unscrewed about three turns, adjust the oscillator trimmer until a station round about 2SM is tuned in at its right spot on the dial, and line the aerial trimmer until best volume is obtained.

Now turn to the top of the dial, and tune in a station. Line the padder for best volume, adjusting the tuning control as you do, for the padder will move the stations about on the dial. When properly lined here, the dial marking should approximately coincide with the stations.

A further check over the gang trimmers once more, and the set is lined.

Careful adjustment of the intermediates is now permissible, as long as you mark the position of the slot in each screw head before you begin. A fraction of a turn is all that will be needed.

Before fixing the set in the cabinet, line the set with the rod aerial. One advantage of this aerial is that, unlike the loop, it is practically non-inductive, and the set will not have to be relined for a larger aerial.

Incidentally, two plugs are placed in the back-plate of the cabinet, so that the outside aerial, also an earth, can be attached when desired. The earth wire is attached to the chassis.

The battery and speaker leads come through a hole in the back of the chassis, and there is a slot ready cut in the shelf for their passage down into the battery section. A slot is also provided in the shelf for the rod aerial to pass right down to the bottom of the cabinet.

BATTERIES

The set is designed to accommodate either standard 45 volt light duty batteries, or the special type produced for portable sets. We understand that these portable units will eventually replace the existing light-duty types.

There is also an A battery of 1.5 volts specially produced for this set, which is recommended in place of the standard 1.5 volt cell, as it will have a longer life.

The new B batteries are known as type PR45, and the A battery is type PR60. They are made by Ever-Ready. The A battery has a capacity of 60 amp. hours, which means about 180 hours of life with this set.

One can't, of course, forecast the exact life of the batteries, but they will last long enough to make the set quite economical in practice.

In anticipation of a number of questions being asked about this set, we are here attempting to forecast some of them in advance. Maybe in these answers you will find something which you will want to know about it, before you finally decide to build.

Q.: Could this set be used as a straight-out receiver, or does it suffer in performance because it is a portable?

A.: The receiver has been so designed as to make it equally suitable for home or portable use.

You will notice that all the components are full sized, and there have been no special types included just for the sake of making the set small.

All we have done is to build up a standard receiver on a chassis slightly smaller than usual.

You may wonder why a set such as this is not always built on so small a chassis. There is no reason why it should not be, but we have never seen the sense in making things small just for the fun of doing it. Therefore, in standard receivers, we generally use the standard depth of chassis—three inches, and the remainder of the lay-out to suit.

RANGE

Inasmuch as exactly the same type of coils are used as would be employed in an ordinary set, the performance is just as good. When connected to a large outside aerial, you will find it every bit as sensitive as any other type of four-valve using the 1.4 volt valves. The fact that, on a mere 8ft. of car aerial we have heard 51 stations is enough to indicate that with a larger length of wire you will have plenty of range.

TONE AND VOLUME

Because a small cabinet does not provide as good a baffle as a larger one, the tone will not be quite as good as it would be if you used a console cabinet. This will be noticed mainly in the bass response. No matter what we may do, a bigger baffle will always give better bass.

We don't mean by this that the set has poor tone. Although we may be a bit biased, we haven't heard a portable with a tone, or volume either, which we liked better. You should find it better than many, because so many are built with little four-inch speakers, and the efficiency of these can't be compared with the six-inch types.

BATTERIES

There is one point to remember, if it is contemplated using the set for both portable and home use. The light-duty batteries used, although they are specially produced to deal with the hours one usually expects from a portable, would be on the small side for home use. They would need more frequent replacement. So that a more economical idea would be to change over to a

STARS CONTROL WAVE-LENGTH; USED TO CHECK TUNING FORK

An interesting development in checking the frequencies of broadcasting stations is announced by the A.W.A. Research Laboratory.

THE stars in the heavens have been harnessed to prevent overlapping among broadcasting stations. By their aid, complaints of interference between any of the 121 stations in Australia have been practically eliminated.

To test whether a station is on its wave-length, the scientific staff at the A.W.A. Research Laboratory, Ashfield, employs a tuning fork of high-grade Elinvar steel. This fork, when vibrating, has a natural frequency of 1000 cycles per second, and when its frequency is compared with the frequency of a broadcast station or control equipment in course of manufacture, the slightest variation from an allotted frequency or wave-length is detected.

The paramount consideration regarding the tuning fork, therefore, is either that it must be correct, or, if it is not absolutely correct, that its degree of error should be known to a very precise figure.

Here is where the stars are invoked.

First, the fork must be kept at a very precise temperature and pressure. This is accomplished by enclosing it in a sealed metal cylinder around which are wound automatically-controlled heating elements. At the set temperature, the fork's natural frequency is theoretically exactly 1000 cycles, although actually it might be 999,999 cycles. When vibrated, its pulsations are recorded on a tape. Parallel with this graph, a further record is made of time signals astronomically controlled, and received by wireless from the great observatories of the world. Any minute deviation of the tuning fork's impulses with those of sidereal time can be measured at leisure, so that the precise error—if any—of the tuning fork at any particular moment is known. The fork thus becomes an infallible measure, and so can reveal any divergence from accuracy on the part of a station under test. In this way, the A.W.A. laboratory is in a position to place any station on its frequency within a minute tolerance.

THE R. & H. PORTABLE

larger set of batteries when the set is used in the home, and connect up the smaller types when the set is to be taken on the road.

The same speaker would do for both cases, and, in fact, it wouldn't take very much time to move both set and speaker from one cabinet to another.

Q.: What is the procedure if I should get so far from any strong station as to make a bigger aerial desirable?

A.: Simple! Carry with you a length of wire about 50 feet long, with a clip at one end. Throw one end of the aerial over the branch of a tree, and clip the other one to the top of the rod aerial in the cabinet. With such an aerial, naturally, the range of the set is much improved. A special aerial socket can be mounted at the rear of the cabinet, if preferred, also one for an earth connection.

Some manufacturers use such an aerial as standard at all times, but in our opinion the smaller aerial is quite all right except in difficult spots, or where one is too far from a station to get good results.

It is a simple matter to screw a clip inside the lid of the cabinet, if you prefer to do this; then the extra aerial will always be with you.

Incidentally, the lid of the cabinet is removable, and the set can be used without it. When packing the receiver into a car, for instance, the lid should always be placed in position to avoid damage to the front of the set.

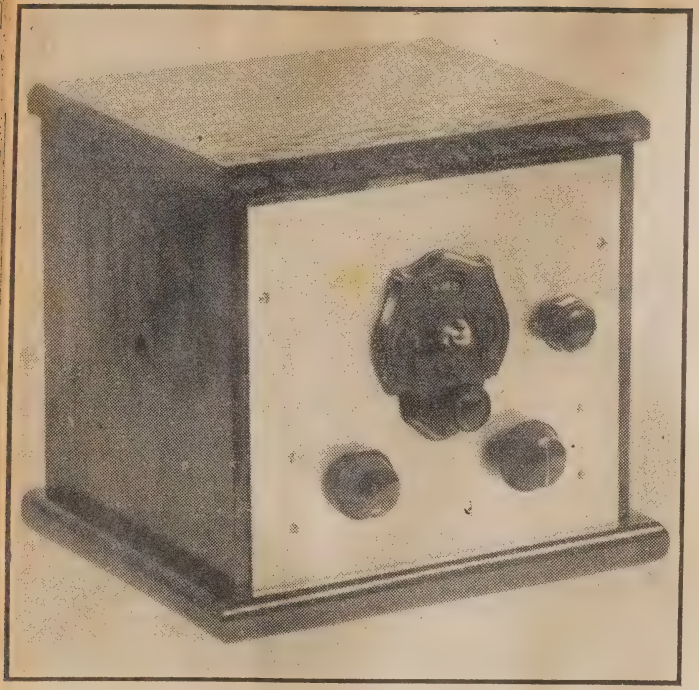
The tuning dial has a celluloid front, in case you should imagine there would be a danger of breaking the glasses. It would be almost impossible to do this unless one gave the set a really hard smack with a broom-handle right into the dial face!

Q.: Are the battery valves liable to fracture in a portable set, or are the filaments liable to damage?

A.: We have taken the receiver round with us everywhere, in and out of the car, round the town for about three weeks, and we have had no indication that the valves are more fragile than any others. We have tacked three-ply back and fronts to the cabinet (in its experimental form), with the set in position, and if they will stand that they will stand anything.

There is no danger of the glass breaking, because there is nothing to break it. The Octal sockets have a very firm grip on the valves, and it is almost impossible for them to come out of their own accord, once securely pushed home.

SOME

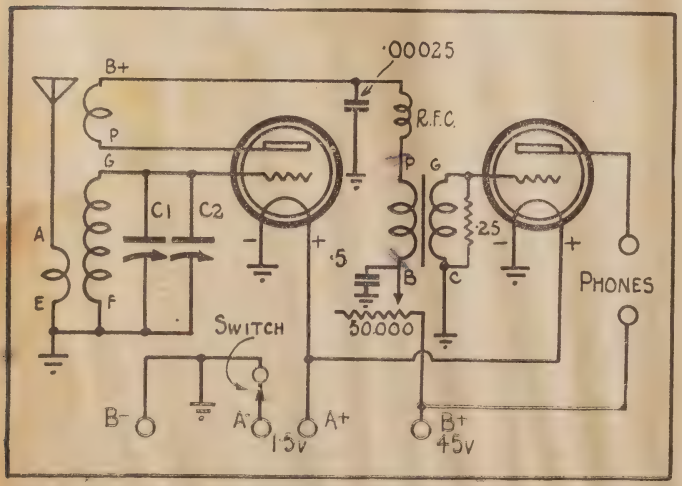


Here is the two-valve set complete with its cabinet. Batteries and all are included. The switch is mounted next to the dial, and leads to it run down under the chassis.

PARTS LIST

1 Chassis, 8 x 6 x 3.
1 Vernier dial.
1 Tuning condenser, .00038 to .0005.
1 3-Plate Midget condenser.
1 50,000 ohms potentiometer.
1 Filament switch.
1 R.F. choke.
1 .00025 mfds. mica condenser.
1 .0001 mfds. mica condenser.
1 2 meg. resistor.
1 .25 meg. resistor.
1 Audio transformer.
4 Terminals.
Sockets—2 4-pin, 1 5-pin.
Set of "Duplex Single" coils.
1 .5 mfds. tubular condenser.
1 45-volt B battery, light duty.
1 1.5-volt standard dry cell.
Cabinet—See article.

A CERTAIN PERFORMER



The two valve circuit—a standard hook-up which has proved itself over many years of satisfactory operation.

WHEN we walked into a popular radio store a few weeks ago and asked this question, "What was our most popular little set?" we were met with an interesting reply.

"Little Jim, over the last year," was the answer, "but the most consistent seller has been the Duplex Single. We've got through hundreds!"

As we walked out we asked ourselves, "What are you going to do about that?"

Our answer wasn't so easy. But in finding it we came to the conclusion that this issue merited something specially for the builder of Duplex Singles and the like—something which was useful, if it couldn't be original.

So we decided, after some thought, to write a well illustrated article about little sets and how to build them. We further determined that illustrations were better than many words.

So this article will be brief, but in it you will find a number of circuits meant to be built up on a standard chassis, which will fit into a neat little cabinet to house both set and batteries. Photographs and wiring diagrams will use up nearly all the space, so as to present our story as clearly as possible.

VALVES

Simple sets are usually built by light purses. As a result, often old and out-of-date apparatus must be pressed into service. To place ourselves in the position of many readers, we hunted through the junk-pile, and brought to light some old-timers. Selecting the most presentable, we built the two-valve set illustrated. We'll tell its story first,

ALL-WAVE

The Duplex Single was an all-wave set. It performed this miracle by using a full-sized tuning condenser to cover the broadcast coil in one bang. For accurate short-wave tuning a little three-plate midget was connected in parallel for simplicity. This idea works.

You just find your short-wave band on the big condenser and tune in with the little one. It will just about spread the ordinary short-wave bands over its full range. Excellent and fine control is yours.

You don't use the full tuning range of the big condenser for each band. As soon as you get to 31 metres on the first short-wave coil, for instance, you jump to the next. This allows you to avoid too much capacity, and, as a result, poor efficiency in the tuning circuit.

The coils used are a standard Duplex Single set, which now can be bought from almost any radio dealer. He can soon get them for you, anyhow, and R.C.S. make them up for us.

REGENERATION

We have found that a variable resistance in the plate lead of the detector is best and smoothest with this circuit. Regeneration is possible over practically

SIMPLE ALL-WAVE SETS

for battery operation

It is not our intention, in moulding the technical policy of RADIO AND HOBBIES, to forget the beginner in radio construction. We believe there will always be beginners, who love to build and re-build simple sets. This article has been written specially for these people, young and old. All the circuits here are standard, and the layout will allow extension and experiment with the least possible expense and trouble.

the full tuning range of the big condenser if required.

Also, it doesn't affect tuning as much as the condenser method, which, however, is quite a good one.

We used an old Philips audio transformer as typical of many which can now be bought for a few shillings almost anywhere. It's a good transformer.

As we wanted to keep the B battery no higher than 45 volts, resistance coupling was ruled out. Also, the transformer gives much more gain.

BATTERIES

Our set uses only a 45-volt light-duty B battery. This is quite enough for good headphone strength, and takes up little room.

As the drain of the set is very low, and the emission from the filament much below maximum, a 1½-volt cell is ample for practically any 2-volt type. We used a pair of 30's and any others we had round the place. No improvement was noticed on jumping up to 2 volts.

The standard type dry cell lies nicely on top of the B battery, so that the cabinet can hold the lot. The lid lifts up for coil changing.

We have shown a picture of the little set out of the cabinet, with the batteries in place.

DIAGRAMS

As this is a popular set, we have drawn out the wiring diagrams in full, and nearly full size. You'll see them on another page. Also, the chassis dimensions are given (it is three inches deep) and the positions of all the main holes.

You can cut the socket holes with an ordinary 1¼ inch wood bit lubricated with machine oil.

Any tuning condenser between .00035 and .0005 will do. Our old dial is a Pilot type, and any other panel mounting type will suit. See that it has no backlash.

CIRCUITS

The circuit of the 2-valve set is shown first. The .25 meg resistor is wired across the secondary of the transformer to guard against harsh reaction.

The second circuit is similar to the first, but it uses the 19-valve in a twin circuit. This set gives practically as much volume as the first 2-valve, as there are actually two valves in the one glass envelope.

The layout and chassis are exactly the same, except that the second valve socket isn't required. This valve has a six-pin socket—check with a data sheet for the actual connections to each triode section. Corresponding plates and grids are placed next-door to each other. "Little Jim's Mate" of last month will give them to you.

The third circuit is the simplest of all, as it uses only one valve. On it you can get excellent headphone strength from all locals, and quite good results on short waves. But they won't be as loud as with the 2-valver, although you can easily add the second valve any time you like.

This circuit is just the same as the first half of the 2-valve set.

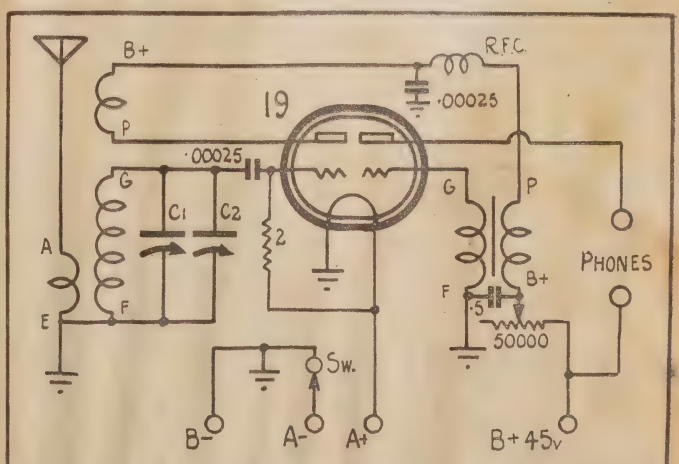
THE CHASSIS

The chassis measures 8 inches by 5½ inches by 3 inches deep. It could have been smaller, but there would be no advantage, and we didn't want to crowd things together.

The front panel is 9 inches by 8 inches. It is bolted to the front end of the chassis.

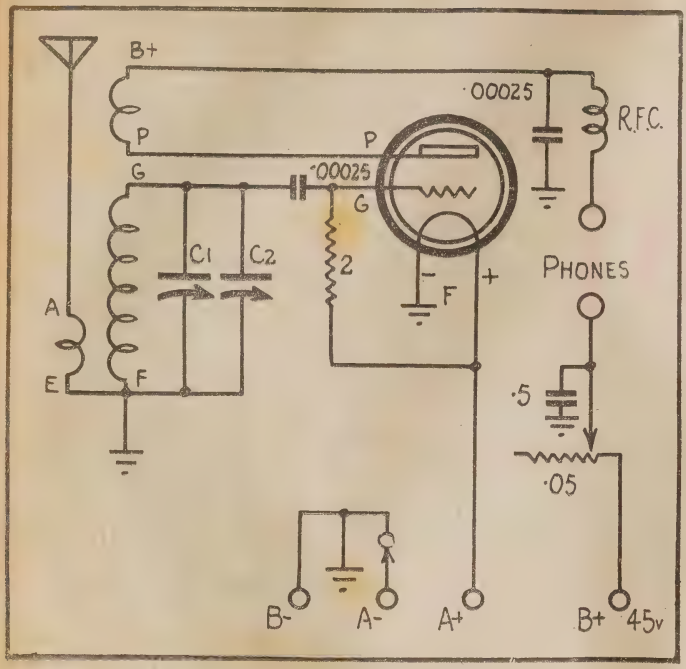
The placement of parts isn't at all critical to a fraction of an inch, so don't lose sleep if you get them half an

USING THE 19 VALVE



How to use the 19 valve in this layout. Coils and tuning condensers are exactly the same as for the two valver. Condenser reaction, as in "Little Jim's Mate" of last month, can be used if desired.

THE SIMPLEST CIRCUIT



The simplest circuit of all—a one-valver. Again, the standard condenser reaction circuit will prove quite satisfactory.

inch out of line. We just adopted the layout as a convenient one.

Likewise, the transformer can be mounted under the chassis, if you like.

The 50,000 ohms potentiometer has only two terminals used. Buy a new one here, as an old one will probably be noisy. You could use a .1 instead of .5, but the latter is better, and keeps the control from making a noise when moved.

The R.F. choke can be almost anything. Goodness knows who made the one we used!

The sockets can be the ordinary cheap wafer types. As long as the mica condensers are mica, they will do—likewise the grid leak.

These are so cheap you can easily buy new ones.

The three-plate midget is an old Radiokes type, which may be picked up quite cheaply.

VALVES

Here are some of the valves which can be used with the 1.5-volt battery. Type 30, PM1HL, PM2DX, B228, 19, WD11, WD12, A209, &c. Don't use valves classed as output triodes, such as the 31, 120, &c., as these are rather hard on the A battery, although they will work.

You could use a 4½-volt C battery on valves such as the A409, B409, PM4, PM4DX, &c.

You can also use the 2-volt screen grid types, if you connect the plate and screens together. The grid connection will come from the top, except in the case of the old type European valves, which are not particularly recommended.

These valves can be used in either socket.

Don't use pentode output valves as a rule, because 45 volts is rather low for them, although they will work with correct plate and screen connections. The screen would be connected to the full 45 volts. But, as a rule, the filament current will be a bit high for long life from a single dry cell.

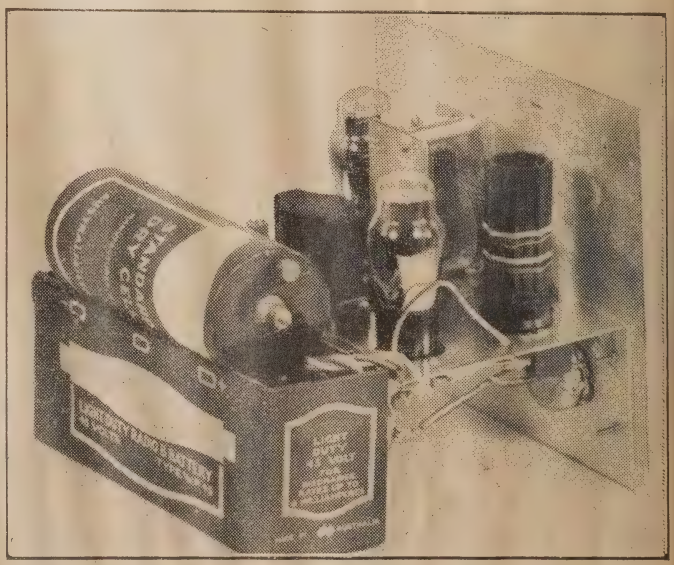
THE CABINET

Our cabinet was 8½ inches deep and 8¾ inches wide, and the outside measurements of the front were the same as the panel. You can easily knock up such a cabinet from an old butter-box nailed together and given a coat of duco.

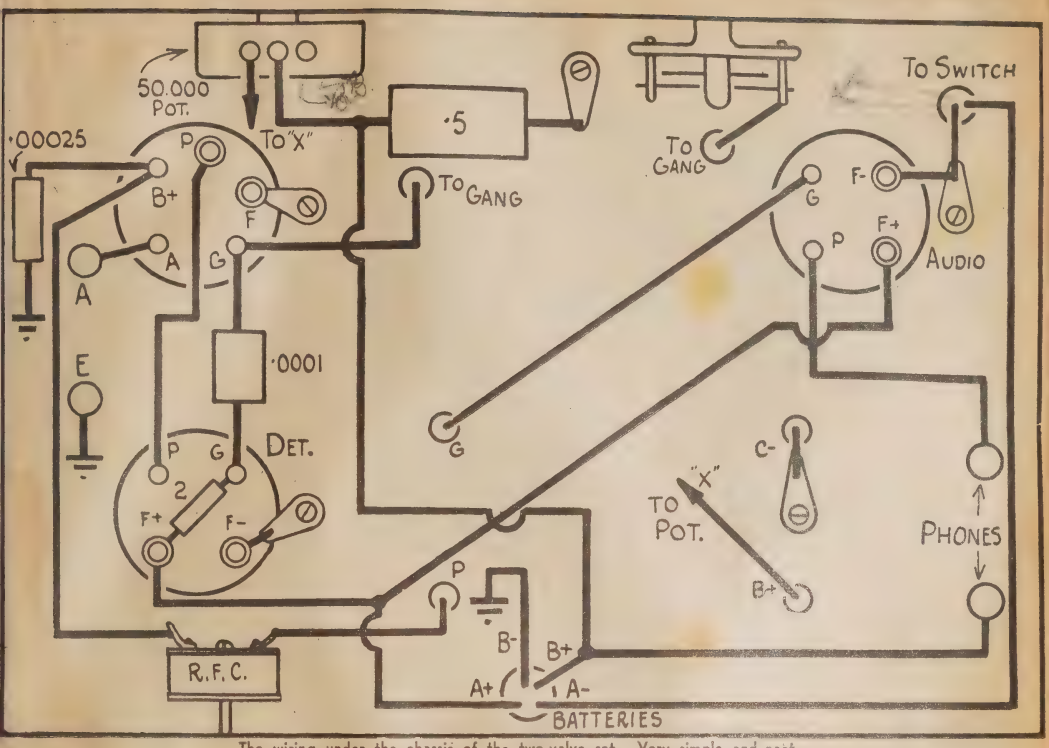
Holes are drilled in each side to take phone connections and aerial and earth connections. Test the cabinet for fit as you make it, in case your measurements have different from ours.

The result will be a neat handy little set no matter what circuit you adopt The beauty of it is that you can try almost any type you like, without much alteration.

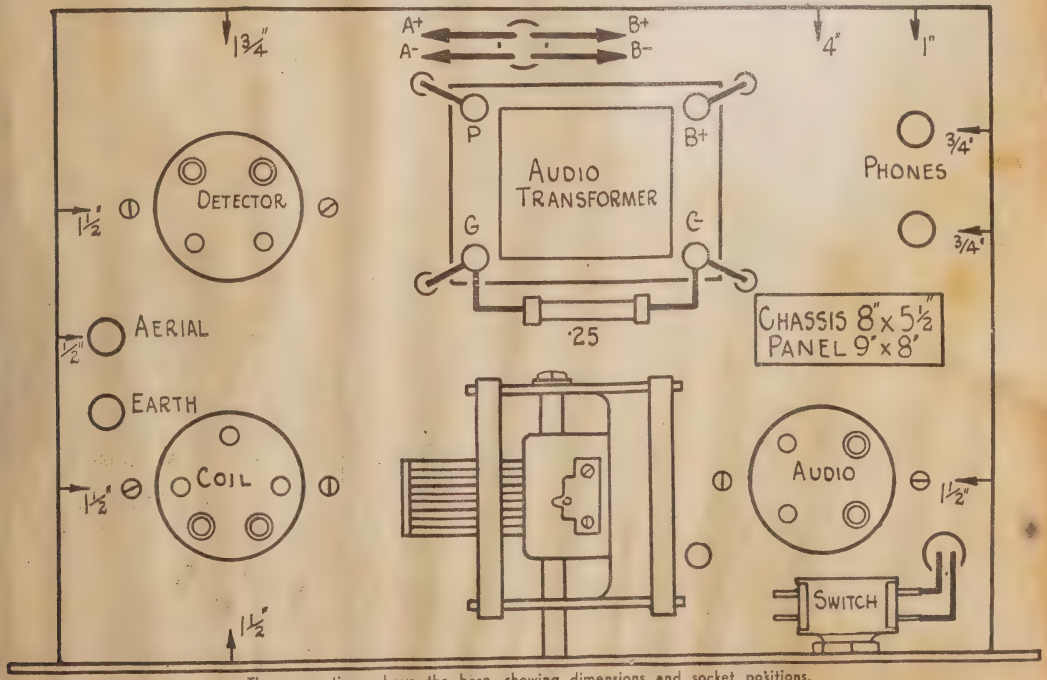
If you use condenser reaction, it will mount in place of the 50,000 ohms potentiometer, and don't forget to connect the frame and fixed plate moving plates to the chassis, if the condenser doesn't make good contact as it bolts into place.



How the batteries and set would look if you suddenly caused the cabinet to vanish. Dimensions are worked out to allow everything to fit in.



The wiring under the chassis of the two-valve set. Very simple and neat.



The connections above the base, showing dimensions and socket positions.

S. W. TUNING CHART

13 Metres

No stations now audible at entertainment level.

☆

16 Metres

GSG, London, 16.86m., 11.0 p.m. till midnight.
GSV, London, 16.84m., 11.0 p.m. till midnight.
DJE, Berlin, 16.89m., 11.0 p.m. till 2.0 a.m.
DJH, Berlin, 16.81m., 11.0 p.m. till midnight.
W2XE, New York, 16.82m., 9.30 p.m. onwards.

☆

19 Metres

GSF, London, 19.82m., 3.0 p.m. till 5.15 p.m.
GSO, London, 19.76m., 3.0 p.m. till 5.15 p.m.
DJB, Berlin, 19.74m., 5.0 p.m. till 6.0 p.m.
2RO6, Rome, 19.61m., 6.30 a.m. till 7.0 a.m.

☆

25 Metres

VLR3, Lyndhurst, 25.25m., 1.0 p.m. till 6.0 p.m.
GSD, London, 25.53m., 3.0 p.m till 5.15 p.m.
XMHA, Saigon, 25.32m., 9.0 p.m. till midnight.
XGOY, Chenking, 25.21m., 9.0 p.m. onwards.
RNE, Moscow, 25.00m., 2.0 p.m. and later.

☆

31 Metres

VLR, Lyndhurst, 31.32m., good at 10.30 p.m.
GSC, London, 31.32m., 6.30 a.m. till 7.0 a.m.; 7.20 a.m. onwards.
W6XBE, San Francisco, 31.48m., 10.0 p.m. onwards.
TIPG, San Jose, 31.18m., 10.0 p.m. onwards.
TAP, Ankara, 31.70m., 6.30 a.m. till 8.0 a.m.
2RO3, Rome, 31.13m., 6.30 a.m. till 8.0 a.m.
DJX, Berlin, 31.01m., 6.30 a.m. till 7.20 a.m.

☆

49 Metres

"RADIO SAIGON," 49.05m., 10.0 p.m. onwards.
VK9MI, Kanimbla, 49.54m., 9.30 p.m. till 10.30 p.m.
XEXA, Mexico City, 48.6m., 10.30 p.m. till 11.30 p.m.
YDA, Tanjong, Priok, 49.6m., 10.0 p.m. onwards.
ZHJ, Penang, 49.51m., 11.0 p.m. till 11.40 p.m.
W8XAL, Cincinnati, 49.5m., 9.30 p.m. till 10.0 p.m.
CRY9, Macao, 49.18m., Mondays only 11.30 p.m. till 1.0 a.m. Tuesday.

Times shown are not always actual opening times, but indicate in most cases when best reception may be expected.

OVERSEAS BROADCASTERS

W6XBE IS NOW OUTSTANDING

31M. BAND GOOD

DURING the past month general listening conditions have been somewhat erratic, though there have been plenty of occasions when really excellent reception has been obtained from quite a number of the stations who radiate their programmes in our direction.

Daventry: With the new operating times for transmission number 1 now in force, namely from 3.0 p.m. till about 5.15 p.m., the majority of listeners are not now able to tune into this session, but there is ample breakfast time fare from GSC in the 31 metre band from 7.0 a.m. till 8.0 a.m., and also quite often from GSG and GSV in the 16 metre band late at night.

Berlin: The Germans still give us a good signal from DJB in the 19 metre band around 5.0 p.m., while in the mornings there is DJX on 31.01, which is always good until they close at 7.20 a.m., while when the 16 metre band is active, DJH and DJE are very good entertainment.

Italy: The Italian stations can always be relied upon to give us really high-class music, and from 2RO3 on the 31 metre band in the mornings the English announcer gives a detailed description of the various works to be performed by their orchestras.

U.S.A.: Of the Americans now being heard, pride of place must be given to W6XBE on 31.48 metres, who is excellent speaker strength every night from 10.0 p.m. A very interesting news service is also given at 10.30 p.m. Another American which has been heard at good strength is W2XE in the 16 metre band, who opens at 9.30 p.m., and gives a snappy programme of the variety type.

Costa Rica: As mentioned elsewhere, HCJB, The Voice of the Andes, on 24.08 metres, is giving special programmes for Australia and New Zealand this month, and no difficulty should be experienced by listeners in hearing this one as they come in at very good strength.

For those listeners who care to stay up till after midnight there are quite a few stations coming in very nicely, to mention but a few—ZHP Singapore, on 30.94 metres; ZHJ, Penang, on 49.51 metres; KZRM, Manila, on 31.35 metres; and TPB3, Paris, on 16.81 metres. While perhaps not of entertainment value, but nevertheless interesting, are the various Indian, Chinese, and Dutch East Indies stations with their native type programmes.

THE MONTH ON SHORT WAVES

Winter Conditions Prevail

Hitler's Speech

The arrival of winter conditions, coupled with extensive sun spot activity during the last few weeks, has given listeners an exciting time. On some days reception would be absolutely nil then the next would be excellent, making it very difficult to arrive at a conclusion as to how conditions really were.

Many interesting broadcasts were heard during the month, perhaps chief of which was the broadcast by Chancellor Adolph Hitler, on April 28. At our location the best reception of his speech was obtained from W6XBE on 9530kc. and after a translation in English had been given, the views of various U.S. senators was given from the Washington studios of the National Broadcasting Company. Two other stations relaying the speech were KEI, 9490 k.c., and KKZ on 13,690 k.c.

16M. ERRATIC

A general summary of receiving conditions at the time of writing, shows that the 16 metre band is very erratic, one night being useless and then coming to life again the very next night. The 19 metre band, which gave us such good reception during the summer evenings, has now completely faded out, but in the late afternoons the Empire transmitters and Berlin are still very good strength. The 25 metre stations have been rather poor with practically no worthwhile reception from distant points with the exception of GSD, which puts in a good signal towards 5.0 p.m. The ever-popular 31 metre band has been really excellent at night from 10.0 p.m. onwards and also from about 7.0 a.m. there are numerous European, U.S.A. and South Americans to be heard. The 49 metre band has been somewhat disappointing as a few weeks ago it showed promise of giving us good reception from South America, but at our location the band has slowly gone off till only the more powerful stations can be heard.

A charming picture of a very old wooden house in the Swiss village of Schwarzenburg, where the new Swiss short-wave station is being erected.

ITALY AND FRANCE ON 7m.c.

NEW CHANNEL NOW IN USE

As listeners will remember, the International Communications Conference, held last year in Cairo, assigned the above frequency band to be shared by amateurs and European broadcast stations.

Up to the present there has not been much development in this regard, but now we find quite a number of stations taking advantage of these new frequencies. Latest advice from Italy shows that Rome now has a new transmitter on 7220 k.c., working under the call letters 12ROII. We also have the new French station on approximately 7280 k.c., which is heard so well in the mornings, so it seems that before long we will have quite a bunch to sort out from the various amateurs who also use the same band.

While the Conference only mentioned European stations, we find that stations in other parts of the globe are also using this band, e.g., JLG on 7288 k.c., and the new one in Bagdad, Iraq, Y15KG on 7200 k.c.

From an English magazine we learn that the B.B.C. may use two new stations in this band, to take the air towards the end of this year, so eventually it may be as crowded as the other bands are at present.

YOUR LETTERS!

AT this point we would like to thank the numerous readers who have written us in appreciation of the short-wave section, and can assure them that with their help we shall endeavor to maintain the standard we have set in the first two issues.

From our correspondents' letters it would appear that they would like the "Listen for These" pages made a regular feature. Due to limitation of space, it may later become necessary to publish these lists every second month, in order that space may be found for the other general notes of new stations, readers' reports, &c. However, before this is definitely decided upon we would like the opinion of any other of our readers, so please send in your comments as soon as possible, in order that we may meet the wishes of the majority of our readers.

LITHUANIA ON 19 METRES

AS previously reported in the April and May issues, the Lithuanian station LYR, located at Kaunas, had been heard on several occasions while using their 9300 k.c. frequency. Since that time we have heard them again at quite good strength on 15,310 k.c., 19.60m. When first heard early in April, they were naturally much louder than they are now, but by careful tuning between 11.0 p.m. and midnight, they can be found, and can be recognised by their interval signal of about 13 notes at midnight. We understand the call sign of this transmitter is LYZ4. In passing we might mention we have just received our verification from LYR, which took the form of a very attractive card showing views of Kaunas, also details of the station. They give frequency as 9285 k.c. and power 500 watts.

This verification from Lithuania brought our list of countries verified up to 103.

READERS REPORTS

We want you to tell us how you have found things over the last few weeks. Write to us about any outstanding reception you have experienced. Others will find them interesting.

Mr. L. J. Keast, Randwick, N.S.W., remarks on the peculiarity of the 16 metre band at night, and also mentions that on the night of the eclipse of the moon this band was excellent. Mr. Keast is a recognised authority on Oriental stations and sends us a valuable list of Japanese stations, which unfortunately, space does not allow us to print. Regarding the Scandinavian station you are hearing on 15,310k.c., we would suggest that this is the Lithuanian, LYZ4.

* * * * *

Dr. K. B. Gaden, Thargomindah, Qld., tells us that daylight reception is well on the way to winter conditions in his locality, and judging by his reception last year, he should soon be able to furnish us with some interesting logs.

* * * * *

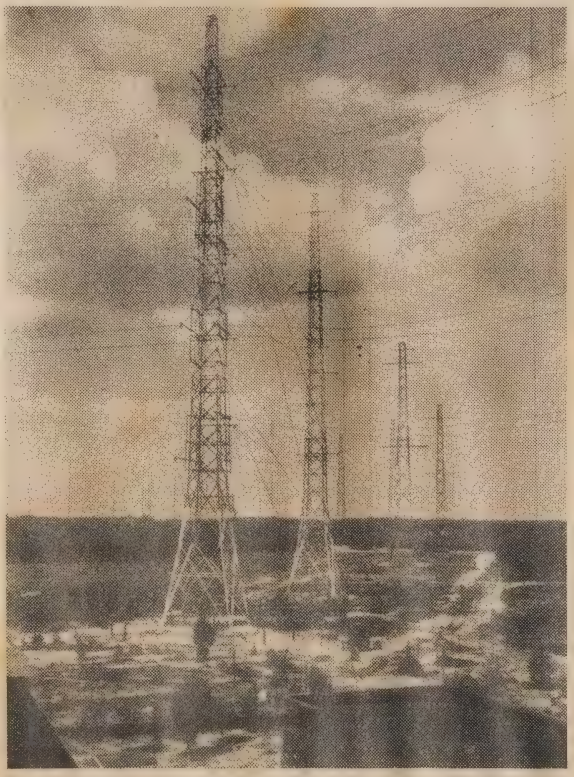
Mr. A. Lee, Dubbo, N.S.W., furnishes us with a very comprehensive log, which unfortunately, we did not receive in time for inclusion in last month's issue. Mr. Lee must now have a very interesting collection of QSL cards and station literature. Your second letter just received and your loggings are incorporated in the Listen for These Section. Reception must be very good in Dubbo just now.

* * * * *

Mr. Seth Horne, Mayfield, N.S.W., is a very enthusiastic listener and uses a modern five valve receiver with which he obtains excellent reception. XGOY, in Chungking, was heard at good strength with their English news session. We might mention that we also found the Newcastle district very poor for reception while stationed there for a few months last year.

* * * * *

"K.Mc.", North Fitzroy, Vic., who is one of the most successful of Victorian listeners, and always seems to pick up the elusive stations not generally heard, sends us an interesting letter, which we have replied to by mail. Keep up the good work and let us know all your new loggings. Thanks for second letter and will write you soon re contents.



The aerials of DJA in Germany—received on a postcard verifying reception. As will be seen it uses a curtain array as a beam array.

ULTRA-HIGH FREQUENCIES

CHANGING CONDITIONS

THE nine and 11 metre bands have been very changeable during the last month, being good for a few days and then dead for sometimes four days in succession.

As reported in the stop press last month, W4XA is now on 26,150k.c., and can be heard every day, when the band is open. Their address is National Life and Accident Insurance Co.

The most interesting new station heard during the month, was KAOC, on 31,460k.c. This station is located at Wichita, Kansas, and is operated by the Kansas Gas and Electric Co. They announced as special emergency station KAOC carrying out tests with their service car, to determine quality of transmission and signal strength in the service area around Wichita, Kansas.

On 31,600k.c., W9XPD can usually be heard at quite good strength around 11.0 a.m.

The various police transmitters have also been heard very much better than last month, quite a number of new ones having been logged.

NEW FREQUENCY FOR W2XUP

We have just received advice from overseas that W2XUP, New York, will shortly change its frequency to 26,100 kc and employ 1 kw power. On the same frequency will be a new transmitter of 100-watt power, which will be located in Kansas City, Mo.

Very shortly we hope to be able to publish a list of police radio stations giving new calls and locations. This will be authentic, as it will be supplied through the F.C.C.

Stations actually heard during the last month are as follows:—

W6XKG.—25,950k.c., Los Angeles, Cal.
W8XNU.—25,950k.c., Cincinnati, Ohio.
W4XA.—26,150k.c., Nashville, Tenn.
W9XA.—26,450k.c., Kansas City, Miss.
W9XTA.—26,500k.c., Harrisburg, Ill.
W2XQO.—26,550k.c., New York, N.Y.
PO6ZA.—27,980k.c., Hollandia, D.N.G.
WQKB.—30,700k.c., Evansville, Ind.
KQBR.—30,700k.c., Alemeda, Cal.
KQKB.—31,100k.c.—?
KAOC.—31,460k.c., Wichita, Kan.
WQKC.—31,500k.c., New Rochelle, N.Y.
WQLJ.—31,500k.c.—?
WQXO.—31,500k.c.—?
KQDH.—31,500k.c.—?
W1XKA.—31,600k.c., Springfield, Mass.
W5XGB.—31,600k.c., Houston, Tex.
W9XPD.—31,600k.c., St. Louis, Miss.

FLASHES! FROM EVERYWHERE

STRAITS SETTLEMENTS.—We understand the Malayan Government is constructing a new short wave station, Kuantan, Pahang. It is not certain whether this will be a short wave or broadcast station.

COSTA RICA.—TIPG, "La Vox de la Victor," which has been heard so well recently on 9690k.c., has now changed frequency to 9620k.c., where it comes in much better, being free from interference from ZHP.

URUGUAY.—Watch out for CXA6, Montevideo, on 9620k.c., as they will be using this frequency shortly, when their new transmitter is completed. This is the old CXA4, from 6125k.c.

PANAMA.—The once-popular Panama station, HP5J, on 9600k.c., has recently come on the air again, and can now be heard at excellent strength every night, opening at 10.0 p.m.

EIRE.—"Radio Eireann," on 9595k.c., now appears to be opening at 7.30 a.m., instead of closing at that time. After a musical number, news session is given for 15 minutes.

EL SALVADOR.—Watch out for YSD on third Monday of the month from 4.0 p.m. till 5.0 p.m. The frequency is not very suitable, but they can be heard as we have verified them on this wavelength about two years ago, around the same time.

SOUTH AFRICA.—ZRO, Durban, South Africa, is now transmitting on 9753k.c., 30.75m., from 2.45 p.m. till 3.50 p.m., 6.30 p.m. till 10.30 p.m., and midnight till 2.45 a.m We have already heard this last transmission, as reported in last month's issue

AUSTRALIA.—From one of our Victorian readers we learn that the masts for the new National short wave station in Western Australia are just being erected. We believe the call letters will be VLW.

U.S.A.—The well-known station W6XBE, on Treasure Island has been allotted two additional frequencies, namely, 6190k.c. and 21,590k.c., so watch out for them.

VENEZUELA.—The Venezuelan Government is sponsoring an expedition into the jungle of that country and also on the borders of Brazil. A radio transmitter will be used with the call YV9AB, which will transmit on 7222 k.c., 7284k.c., or on 14,125k.c. Anyone hearing them should address reports to Ministerio de Fomento, Servico Technico, Expedicion de la Gran Sabana, Caracas, Venezuela, and they will be verified when they return to civilisation.

GUATEMALA.—Another new station in this country is TGXI, on 6132k.c., which is on the air till 5.0 p.m. Sundays, with a special DX programme.

ECUADOR CALLS US! AUSTRALIA!

LISTEN ON 24.08. METRES

On May 2 the station HCJB, began a regular daily transmission especially for Australia and New Zealand. This transmission commences nightly, except Monday, at 9.30 and continues until the regular Spanish programme comes on at 10.0.

All announcements are in English, and can be followed perfectly, as strength is very good. The frequency used is 12,460 k.c., and no difficulty should be experienced in locating this one, as the call letters, HCJB, are given very frequently, also the station slogan, "The Voice of the Andes."

They ask all listeners to write to them, giving their opinion of these broadcasts, address being P.O. Box 691, Quito, and promise to send a souvenir and verification to all who write.

This station is a semi-religious one, being conducted by the World Missionary enterprise, and in years gone by, we have often heard them conducting prayer meetings, which were being broadcast to similar meetings being held in various parts of the United States.

These special Australian programmes will be continued for the month of May, so readers who have not heard them before will still have an opportunity after reading the above notes.

We have just received a very interesting letter from the director of the station, Mr. Clarence W. Jones, who asks us to advise all listeners that they will be very pleased to receive reports on any of these test programmes, as they especially wish to provide programmes which are of real interest to Australia. They are also on the air for India and the East at 7.0 p.m. and for England and the Atlantic at 8.0 p.m.

This photo of the short-wave station in Switzerland, taken while the snow lay round the new building was sent to us direct from Switzerland.

AIRLINERS AND AERODROMES

IF one listens in the vicinity of 45.8 metres during the afternoons and evenings, some very interesting transmissions may be heard from the various aeroplanes and also the ground stations situated at the main aerodromes. Perhaps the strongest at our location is VHAB, which we presume to be the Kingsford Smith aerodrome, situated at Mascot, N.S.W.

Down on approximately nine metres, the Sydney air beacon can also be heard sending out a continuous stream of dots, with the letters "SY" at minute intervals.

ANOTHER NEW DAVENTRY TRANSMITTER

ON Sunday, May 7, the Empire stations brought another new transmitter into service, GRX, on 9690 k.c., 30.96m. This station has replaced GRY, which has been heard for a few weks, with the broadcasts in foreign languages. The identification word for this new one is a xylophone, and up to the time of writing strength has been very much better than GRY, which never came in with any great strength. This 9690 k.c. channel appears to be very popular, as we know of at least five stations who now use it.

Listen for these!

OVERSEAS STATIONS NOW AUDIBLE

Here is a list of short-wave stations which have actually been heard over the last few weeks. Most of these should be heard by any of our short-wave fans who have a good set and location. Details of each station are given, and when also reported by readers, their names appear in brackets.

NORTH AMERICA

W2XE.—17,830k.c., 16.82m., New York. A new frequency just taken into service and good from 9.30 p.m. (Keast).

W3XL.—17,780k.c., 16.87m., New York. Heard after 11.0 p.m. and also in the forenoons.

W2XAD.—15,330k.c., 19.56m., Schenectady. Heard on some mornings at 7.0 a.m.

W8XBE.—15,330k.c., 19.56m., Treasure Island. Their Spanish programme can be heard weakly at 1.0 p.m.

W8ZK.—15,210k.c., 19.72m., Pittsburg. Heard weakly on some days at 12.30 a.m.

KKZ.—13,690k.c., Honolulu. Heard with special broadcast with Hitler's speech.

CJRX.—11,720k.c., 25.6m., Winnipeg. Quite a good signal on Sunday at 6.0 p.m.

W3XAL.—9670k.c., 31.03m., New York. Comes up to good strength by 4.0 p.m., when they close.

W6XBE.—9530k.c., 31.48m., Treasure Island. This one is now the most popular station on the 31 metre band, and opens at good strength at 10.0 p.m. ("K.Mc."), (McManus), (Lee).

XEWW.—9500k.c., 31.58m., Mexico City. Not as strong as they were a few weeks ago.

W2XAF.—9530k.c., 31.48m., Schenectady. Heard on some mornings at 7.0 a.m.

W1XK.—9570k.c., 31.35m., Boston. Quite a good signal in the afternoons between 3.30 p.m. and 4.0 p.m.

KEI.—9490k.c., 31.61m., Bolinas. This one also broadcast the German Chancellor's speech.

W8XAL.—6060k.c., 49.5m., Cincinnati. Not heard as well as before, but good between 9.30 p.m. and 10.0 p.m. (Lee).

CJRO.—6175k.c., 48.61m., Winnipeg. On Sundays may be heard until 6.0 p.m.

ITALY

2RO8.—17,820k.c., 16.84m., Rome. On some nights this station is quite well received, and gives excellent musical numbers, in addition to news in English.

2RO6.—15,300k.c., 19.61m. Quite well received at 7.0 a.m. and can also be heard weakly on opening at 7.30 p.m. (Lee).

IQY.—11,670k.c., 25.70m. Heard occasionally at 7.30 a.m., but rather weak.

2RO4.—11,810k.c., 25.4m. Heard best in the early morning, until they close at 2.15 a.m. (McManus).

IRF.—9230k.c., 30.52m. This one was heard one morning opening at 3.0 a.m., but is very much better when on the air around 6.0 p.m. in special programmes.

2RO9.—9667k.c., 31.03m. This one is used in the early morning transmission in chain with 2RO3. Notice the slight change in frequency, evidently to avoid interference with DJX. (Lee).

2RO3.—9630k.c., 31.13m. One of the loudest stations in the mornings around 7.0 a.m., and has frequent announcements in English. (Lee).

SOUTH AMERICA

HCJB.—12,460k.c., 24.08m., Quito, Ecuador. This station is covered in separate article.

CB1180.—11,990k.c., 25.04m., Santiago, Chile. This station was exceptionally loud one Sunday until closing at 3.0 p.m.

CB970.—9730k.c., 30.85m., Valparaiso, Chile. This one is much weaker than last month, but can still be heard until around 3.0 p.m. on Sundays.

CB960.—9600k.c., 31.25m., Santiago, Chile. This station now also opens at 10.0 p.m. at very good strength, and gives physical exercises until 10.30 p.m., after which news in Spanish. Slogan is "Radio Americano."

LRA1.—9690k.c., 30.94m., Buenos Aires, Argentine. A little stronger than last month in their session opening at 8.0 a.m.

LRX.—9660k.c., 31.06m., Buenos Aires, Argentine. Opens every night at 10.0 p.m., with their familiar waltz, which was composed by one of the station staff.

CXA8.—9640k.c., 31.12m., Montevideo, Uruguay. This one is heard best on a Sunday afternoon, but can now also be logged in the mornings at 7.0 a.m.

OAX4T.—9562k.c., 31.37m., Lima, Peru, Again putting in a grand signal on opening at 10.0 p.m.

OAX4J.—9340k.c., 32.12m., Lima, Peru. Heard on Sunday afternoons, until closing at 4.0 p.m. Sometimes uses "Radio National" and at other times "Radio Universal."

HP5K.—6005k.c., 49.96m., Panama City. This one can still be heard opening at 10.0 p.m. (Lee).

FRANCE

TPB3.—17,850k.c., 16.81m., Paris. This is perhaps the loudest of all the French stations at the present time, and now opens at 11.30 p.m., instead of 12.30 a.m.

TPA2.—15,243k.c., 19.68m. This one is now barely audible and even by 11.0 p.m. is very weak.

TPB11.—15,130k.c., 19.83m. Quite a good signal on opening at 5.0 p.m.

TPB7.—11,885k.c., 25.24m. This one only fair at 2.0 p.m.

TPA4.—11,718k.c., 25.6m. This one is slightly better than TPB7, which is used at the same time.

TPB.—7280k.c., 41.21m. A very loud signal is obtained from this comparatively new transmitter.

CENTRAL AMERICA AND WEST INDIES

COBC.—9990k.c., 30.01m., Havana, Cuba. One of the best of the Cubans, opening at 10.0 p.m.

COCM.—9830k.c., 30.53m., Havana, Cuba. Since this station changed hands, they have been much weaker.

COCH.—9437k.c., 31.8m., Havana, Cuba. Not as loud as last month, but still there every night, excepting Monday.

COCQ.—8830k.c., 34.12m., Havana, Cuba. This once popular station has been very erratic of late, but still opens with "Siboney" at 9.50 p.m. (Lee).

RADIO MARTINIQUE.—9700k.c., 30.9m., Fort-de-France, F.W.I. Becoming much better in their session heard here until 7.0 a.m. on Mondays.

TI4NRH.—9670k.c., 31.03m., Heredia, Costa Rica. Only heard once in their Sunday night broadcast.

TIPG.—9620k.c., 31.18m., San Jose, Costa Rica. One of the loudest stations on the 31 metre band at night. Notice change of frequency from last month.

TGWA.—9685k.c., 30.96m., Gautemala City. This station had a special broadcast until 6.0 p.m. on April 16, when strength was very good.

HP5J.—9600k.c., 31.25m., Panama City. As reported elsewhere, this station now opens at 10.0 p.m., with two stirring marches. All announcements in Spanish.

TG2.—6190k.c., 48.4m., Gautemala City. Can still be heard on Sunday afternoons till 6.0 p.m.

TGWB.—6490k.c., Quezeltenango, Gautemala. Opens every night at 10.40 p.m. with physical exercises.

TURKEY

TAP.—9465k.c., 31.70m., Ankara. Another entertainment station in the early morning until 8.0 a.m. (McManus), (Lee).

TAQ.—15,190k.c., 19.75m. This one is very seldom heard now, but can sometimes be heard around 10.0 p.m.

AFRICA

IABA, ADDIS ABABA.—9650k.c., 31.09m., Ethiopia. Very loud on opening at 2.0 a.m., and can also be heard at 7.0 a.m.

ZRL.—9606k.c., 31.23m., Capetown, South Africa. Heard in the early morning around 1.0 a.m. Notice the change in call letters as advised by the South African Broadcasting Corp.

ZRJ.—9606k.c., 31.23m., Johannesburg, S.A. We had the unusual experience of hearing this station at 3.0 p.m. in the afternoon, when their clock struck 7.0 a.m. This was followed by physical exercises. We have never previously heard of a South African station being logged in Eastern Australia in the middle of the day. No Johannesburg station is listed in the S.A.B. Corp. lists, as being on 9606k.c., but we definitely heard location given, so in the meantime have listed it under ZRJ, which is the 6097 call.

TPZ3.—8960k.c., 33.48m., Algiers, Algeria. A little heard station, and probably a new country for a number of listeners. Heard at 5.0 p.m. on two Sundays.

ZRH.—6007k.c., 49.94m., Roberts Heights, S.A. Very good on most mornings around 7.0 a.m. (Lee).

CR7AA.—6137k.c., 48.87m., Lourenco Marques, Mozambique. Not as loud as they were last month, but still audible every morning. (Lee).

ZRJ.—6097k.c., 49.2m., Johannesburg, S.A. Very much weaker than they were last month, but on some mornings reach entertainment level.

INDIA AND ASIA

VUD4.—15,290k.c., 19.62m., Delhi, India. Only a fair signal at midday, but easily identified.

JZK.—15,160k.c., 19.79m., Tokio, Japan. Very good on opening at 10.0 p.m. (Keast), (McManus), (Lee).

YDC.—15,150k.c., 19.8m., Bandoeng, Java. This station is now losing strength. (McManus), (Lee).

KAY.—14,980k.c., 20.03m., Manila, P.I. Heard one night in a special programme at 10.0 p.m.

XMHA.—11,850k.c., 25.32m., Shanghai, China. One of the few night stations on the 25 metre band.

JZW3.—11,720k.c., 25.6m., Tokio. This is a new station which has taken the place of JVN. News in English at 7.55 p.m. (Keast), ("K.Mc."), (Lee).

XGOY.—11,900k.c., 25.21m., Chengking. Heard every night at good strength. (McManus), (Horne).

PLP.—11,000k.c., 27.27m., Bandoeng. Still heard every night and becoming louder. (Lee).

PMN.—10,260k.c., 29.24m. Another of the regular N.I.R.O.M. stations, getting better at our location. (Lee).

JIB.—10.535k.c., 28.48m., Taihoku, Taiwan. This station is very good at midnight with news. (Keast).

JDY.—9940k.c., 30.18m., Darien, Manchukuo. Opens every night at 10.0 p.m. (Keast).

ZHP.—9690k.c., 30.94m., Singapore, S.S. This one has now become quite a good entertainment station, especially towards midnight. (Lee).

JFO.—9625k.c., 31.16m., Taihoku, Taiwan. This station is also quite well heard at midnight. (Keast).

VUD3.—9590k.c., 31.28m., Delhi, India. Comes in very well around midnight. (Lee).

KZRM.—9570k.c., 31.35m., Manila, P.I. Another good entertainment station for those who can seperate it from VLR. (Lee).

YDB.—9550k.c., 31.41m., Soerabaja. Can be heard weakly from midnight onwards.

NEW STATIONS

IN this panel each month will be listed all stations not previously reported which have been heard by readers or at own location during the preceding month.

K.C.	Metres	Call	Location
6,880	43.60	XJOB	Shanghai, China.
8,960	33.48	TPZ2	Algiers, Algeria
9,600	31.25	GRY	Daventry, England
9,690	30.96	GRX	Daventry, England
9,850	30.45	YI5KG	Bagdad, Iraq
13,690	21.90	KKZ	Honolulu, Hawaii
17,830	16.82	W2XE	New York, U.S.A.
27,980	10.72	PO6ZA	Hollandia, D.N.G.
31,460	9.53	KAOC	Wichita, Kan., U.S.A.
31,500	9.52	WQKC	New Rochelle, N.Y., U.S.A.
31,600	9.49	W1XKA	Springfield, Mass., U.S.A.

ZBW3.—9525k.c., 31.49m., Hongkong This one now suffers from interference from W6XBE after 10.0 p.m (Lee).

KZIB.—9500k.c., 31.58m., Manila, P.I Comes in nicely after 3ME closes down ("K.Mc."), (Lee).

HS6PJ.—9500k.c., 31.58m., Bangkok Siam. Heard on Monday and Thursday nights after 11.0 p.m.

JLT2.—9645k.c., 31.1m., Tokio. Excellen from 5.30 a.m. till 7.0 a.m. (Keast) (Lee).

PLV.—9415k.c., 31.86m., Bandoeng. This seldom-heard station came in very well one morning at 12.30 a.m.

XYZ.—6007k.c., 49.94m., Rangoon, Burma Heard very well towards midnight and later. This is the new call sign for this one.

YDA.—6045k.c., 49.6m., Tanjong, Priok Comes in nicely late at night.

ZHJ.—6057k.c., 49.51m., Penang, S.S Can be heard at good strength until 12.40 a.m. and sometimes later.

"RADIO SAIGON."—6116k.c., 49.05m., Saigon, Indo China. Now opens at 10.0 p.m. with a very loud signal (Lee).

XJOB.—6880k.c., 43.60m., Shanghai China. Quite good at 10.0 p.m. and announces in English at 9.30 p.m.

XGXA.—6980k.c., 43.0m., Chungking China. A very good signal from this one and still heard, despite the recent bombings.

PMH.—6720k.c., 44.64m., Bandoeng. Always a loud signal, but all native type music. Heard every night from 9.0 p.m.

CHINESE.—6000k.c., 50.0m. This one has not as yet been identified, but can be heard every night just above XYZ (Lee).

VPB.—6160k.c., 48.6m., Colombo, Ceylon Can now be heard every night with lady announcer from 11.0 p.m. onwards.

JLT.—6190k.c., 48.47m., Tokio. Opens nightly at 11.0 p.m., but interfered with by morse station.

CRY9.—6080k.c., 49.18m., Macao, Portuguese China. Heard on Monday only from 11.30 p.m.

JLG.—7285k.c., 41.18m., Tokio. Heard from 5.30 a.m. till 7.0 a.m., but not very loud. (Keast), (Lee).

JLG3.—11,705k.c., 25.63m., Tokio. This one also heard from 5.30 a.m. until 7.0 a.m. (Keast).

JVP.—7510k.c., 39.95m., Tokio. Used in the session starting at 11.0 p.m., and continuing until 12.30 a.m. (Keast).

(Continued on Next Page)

MYSTERY STATIONS!

THIS month we have no new mystery stations to add to our list, but what is better still, we are able to remove two stations from our first list, and also give a definite call sign to the Norwegian on 9,610kc.

The one listed in the April and May issues on 9,850kc., 30.45m. has turned out to be YI5KG in Bagdad, Iraq. This station is really assigned to 7,200kc., but a few weeks ago was also using 9,850kc. As we stated when first reporting it, we gave a guess that it was in either Palestine, Iraq, Iran or Arabia.

The second one we can remove is the one listed on 7,200kc., 41.67m., which opens at 9.0 p.m. and closes at 11.15 p.m. While we cannot give its exact call letters, it is definitely one of the N.I.R.O.M. stations as we have heard it transmitting same programme as PMN, PMH and YDB as late as 12.30 a.m.

The call letters of the Norwegian station on 9,610kc., 31.22m. are LLG.

This now only leaves the Spanish speaking station on 6,500kc., 46.1m., which we are reasonably sure is HIIL in the Dominican Republic, and the other on 15,300kc., 19.61m. which plays music without announcement from 7.0 p.m. till 7.25 p.m.

U.S.S.R.

RV96.—15,180k.c., 19.76m., Moscow. This powerful Russian station is heard very well at 11.0 p.m. (Lee).

RV96.—15,380k.c., 19.5m. About two weeks ago was very loud at 10.0 p.m., but is now weakening.

RNE.—12,000k.c., 25.0m. Heard quite well on some days at 2.0 p.m., and occasionally at other times. (McManus, Keast), (Lee).

RV26.—9520k.c., 31.5m. Very good at midnight and also just before closing at 7.0 a.m. (Lee).

RAN.—9600k.c., 31.25m. Heard one morning at 12.30 a.m., when they were excellent strength.

RV96.—6040k.c., 49.73m. Only fair at 7.0 a.m., but heard very much better at 1.0 a.m. (Lee).

RV15.—4273k.c., 70.21m., Khabarovsk. On some nights this real old-timer comes through very well. According to information from overseas, this station has also been using the 6040 k.c. frequency, but it is very hard to distinguish it from Moscow.

HOLLAND

PH12.—17,770k.c., 16.88m. Like all other stations on the 16 metre band, it changes from day to day, but when conditions are favorable comes in nicely.

PCJ2.—15,200k.c., 19.71m. Very good on Tuesday nights, at 6.30 p.m.

MISCELLANEOUS

OZH.—15,165k.c., 19.78m., Skamlebaek, Denmark. Quite a good signal is heard on some nights at midnight.

SBP.—11,705k.c., 25.63m., Motala, Sweden. On some mornings can be heard very well on closing at 7.15 a.m., with an announcement in English.

SBO.—6065k.c., 49.46m. Same location. In contrast to some of the other 49 metre band stations, this one is getting very much louder when they open at 7.15 a.m.

CSW2.—11,040k.c., 27.17m., Lisbon, Portugal. Still coming in with a good signal in the early mornings around 7.0 a.m.

ORK.—10.330k.c., 29.04m., Ruysselede, Belgium. Best from 5.30 a.m. until they close at 6.0 a.m., with the National Anthem.

EAQ.—9860k.c., 30.43m., Madrid, Spain. Since the war finished, this station appears to be on a regular schedule again, and is now heard every morning at 7.0 a.m. (Keast), (Lee).

YI5KG.—9850k.c., 30.45m., Bagdad, Iraq. As stated elsewhere, this is one of our mystery stations, which has just been identified. We have only heard it once this last month, but list it in case it uses this frequency again. Verification may be to hand in time for inclusion in the stop press panel.

"RADIO EIREANN."—9595k.c., 31.27m., Moydrum, Eire. Now being heard every second morning opening at 7.30 a.m. with a news session.

STOP PRESS!

NEW DAVENTRY STATIONS

With futher reference to our paragraph re the proposed new stations for Daventry in the 7200 kc-7300 kc band, we are indebted to the B.B.C. for the following information which gives definite details in this regard.

The B.B.C. has notified two frequencies in the new 7 mc's band, which will become available in September, as a result of the recent Cairo Conference. These are GSU, 7260 kc 41.32 m., and GSW, 7230 kc 41.49 m. The identification words for these two new transmitters will be Unity and Westminster respectively.

All the available call signs in the GS series having been allotted, it has become necessary to start a new series, which will be of the form GR-. The reason for this choice is that, alphabetically, GRZ immediately precedes the first call sign of the GS- series, GSA. All new Daventry call signs will, therefore, be of the GR- series, beginning with GRZ, GRY, etc.

As readers are aware, GRX and GRY are already on the air, and we may shortly hear another new one, GRZ, "Z" for zero on 21,640 kc 13.86 m.

U.H.F. RECEPTION IN QUEENSLAND

From Dr. K. B. Gaden, in Thargomindah, comes a very interesting letter advising that he has recently succeeded in logging W4XA and W6XKG in the 11-metre band. Reception was quite good, especially from the former, and, as the doctor puts it: "This 11-metre band is going to keep me away from the stock regulars, I fear." We can certainly endorse Dr. Gaden's comments in this regard and can assure readers that once they start logging these 9 and 11 metre stations they will find it hard to return to the lower frequencies, though, of course, all receivers will not tune down to these lower wavelengths. This is a point which manufacturers will very shortly have to give serious thought to, as we feel sure that listeners will demand these wave bands to be included in next year's receivers.

SP31.—9520k.c., 31.49m., Warsaw, Poland. On some mornings is quite fair just before 6.0 a.m., but still interfered with by the Russian.

LLG.—9610k.c., 31.22m., Oslo, Norway. Every morning this station can be heard at varying strength. Call letters are LLG.

RADIO BURGOS.—7250k.c., 41.2m., Burgos, Spain. This former rebel station has apparently settled down to be a regular station.

CS2WD.—5977k.c., 50.15m., Lisbon, Portugal. Can be logged every morning, reaching a peak around 7.15 a.m.

HVJ.—6190k.c., 48.4m., Vatican City. Heard in a special broadcast one morning at 5.30 a.m.

N.I.R.O.M. STATION.—7200k.c., 41.67m. This is one of our mystery stations from the April and May issues. While we do not as yet know its call letters or location, we have definitely placed it as one of the Dutch East Indies stations, as on one occasion we heard it transmitting the same programme as PMH and on another, they were giving the same broadcast as PMN. These native type stations are very hard to place as no English is used.

THIS MONTH'S VERIFICATIONS

During the last month we have received the following verifications which will be a guide to readers who are expecting cards from the same stations:—

W9XH, South Bend, Ind.; W9XTA, Harrisburg, Ill.; W6XBE, Treasure Island; CRY9, Macao.; CHNX, Halifax, N.S. All the above were first reports received from Australia.

In addition we also received cards from HIN, Cindad Trujillo, Dominion Republic; HI3X, same location; HCJB, Quito, Ecuador; W4XB, Miami, Flo.; WQKB, Evansville, Ind.; Addis Adaba, Ethiopia; COBX, Havana, Cuba; Radio Martinique; W8XNU, Cincinnati, Ohio; LYR, Kounos, Lithuania.

"RADIO MARTINIQUE" VERIFIES

A very attractive verification card has just arrived from the above station. This French West Indian transmitter is now audible on week mornings, in addition to the session concluding at 7.0 a.m. on Mondays.

HIGH IMPEDENCE GRID CIRCUIT

Special Conditions For Microphone Pre-Amplifiers

When crystal microphones are used a load impedance of about 5 megohms is frequently specified. As is well known, the maximum resistance normally permissible in the grid circuit of a valve is 1 megohm, which may be increased to 2 megohms for certain valve types when resistance coupling is used.

It has been found possible to increase the grid circuit resistance still further with certain valves provided that the heater voltage is decreased and that resistance coupling is employed. Radiotron 6J7-G (6C6) has completed extended life tests with a heater voltage of 4.5 volts.

Although under these conditions the mutual conductance shows a slight decrease, this is comparatively unimportant, and the life of the valve when used with limited plate current is extremely good. No other valve types are at present recommended for this application since their operation with reduced voltages may be unsatisfactory.

MAXIMUM 250V.

It is recommended that the plate supply voltage should not exceed 250 volts, that the plate load resistor should not be less than .25 megohm, and that the screen voltage be derived from a screen dropping resistor of 1.5 megohm from the plate supply voltage. Under these conditions the cathode bias resistor should be 2000 ohms.

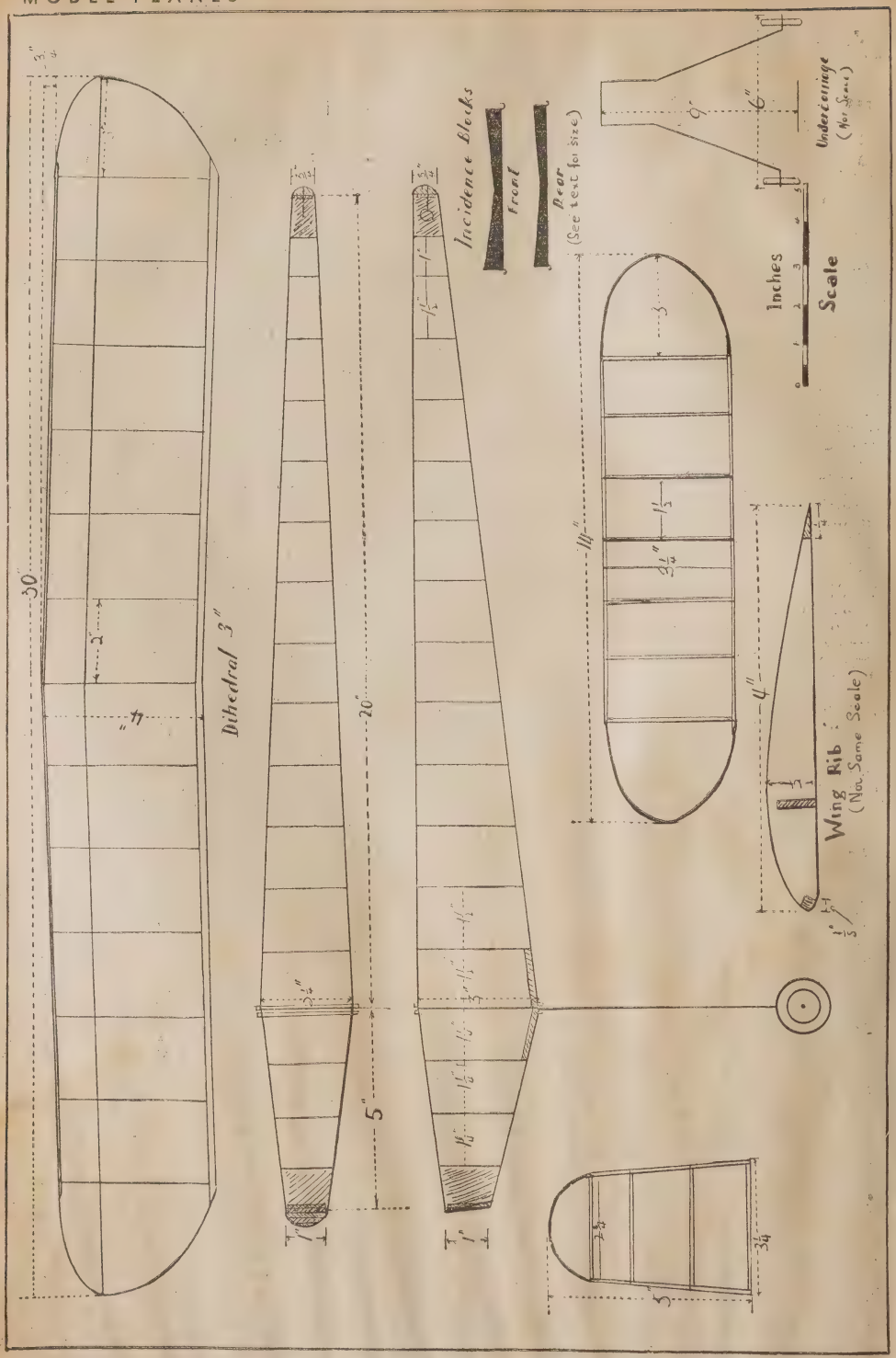
Smaller values of plate load resistor may be used provided that the plate current does not under any circumstances exceed 1 mA. A plate supply voltage lower than 250 volts is desirable in such cases. The stage gain may be taken as being approximately the same as for full heater voltage.

The reason why high values of grid circuit resistance are restricted is that in all valves there is a certain negative grid current flowing under normal operating conditions. The two main causes of this negative grid current are, first, "gas current," and, secondly, "grid emission current."

GAS CURRENTS

Gas current is approximately proportional to the plate current, and when the plate current is reduced, as with resistance coupling and a high value of plate load resistance, the gas current will be quite small. Grid emission is caused by the emission of electrons from the control grid due to the combined heating by cathode and plate. By reducing the voltage across the heater the cathode temperature is considerably reduced and the grid heating reduced with it. Heating due to the plate is reduced, due to the low plate current brought about by the high load resistance.

—Radiotronics.



These diagrams will give you all the measurements and dimensions of the fuselage, wing and tail assembly. The drawings of the propellor block are given overleaf.

Building THE R. & H. "TRAINER"

a 30-inch R.O.G. model

In this article, we present complete details of a model plane, specially designed for readers of RADIO AND HOBBIES. Its design has been worked out with certain results as the chief object. It incorporates the latest ideas in model planes, and the greatest care has been taken to present every detail in diagrams and description.

THE outstanding qualities of this 30-inch fuselage model are its consistent performance and the ease with which even the veriest beginner can construct it.

In the design, care has been taken to eliminate the most difficult and tedious parts of the construction without impairing flying qualities.

The original model built from the plans gives excellent R.O.G. performance without needing any tricky adjustment. The climb is excellent, without any tendency to stall, and the glide is smooth enough to ride the lightest air current. From this model you can expect regular flights over the minute mark, even if it's your first model.

TOOLS

The tools which you will require are simple. A razor blade, a sharp knife, a pair of round-nosed radio pliers, and we suggest a Balsa stripper—a much more efficient method of cutting Balsa strips than the old knife and straight-edge style.

We suggest, too, that you seek the co-operation of your model dealer in choosing the grade of wood for the job. Balsa comes in many grades and needs to be chosen for a set job. For instance, the grade of Balsa used as fuselage longerons would be much too heavy for wing ribs. Similarly, the wing rib grade would be too soft for spars or longerons. Tell your dealer what you intend to do with the wood and let him help you choose it.

CONSTRUCTION

Having chosen the materials, let's get down to work.

The first thing to do is to draw up the plans full size. Read the measurements from the plan and scale up your drawings. Be careful to get everything accurate.

Start off with the fuselage. Draw up the side-view full size, marking the positions of the struts. Note that the foremost strut leans backward about 1-8 in. This is to give the propeller "downthrust." By nosing down the propeller in this manner stalling is overcome.

Cut the 1-16 Balsa into square strips, cut the top and bottom longerons and pin them into position on the plan. If care is taken, both sides of the fuselage can be built at the same time, one on top of the other.

Having pinned the longerons into place the struts are cut to size and cemented into place with a touch of acetone cement.

While we are waiting for these sides to dry we can get started on the wing.

Draw up the wing plan full-size, allowing for the correct amount of sweepback, and on the drawing, pin the trailing edge and mainspar into position. The trailing edge is a strip of Balsa, 1-16in. x ¼in. It should be cracked at the centre to allow for sweep-back, and then touched with cement to seal the break. The mainspar is a strip of 1-16 Balsa, 3-8in. deep. This should be pinned into position and cut at the centre. Later on, when the wing tips have been placed in position one tip will be raised in order to allow for the dihedral angle. That means that the spar must be cut at an angle at the centre to allow for this raising of one tip.

MATERIALS REQUIRED

The materials you'll need are:—

One sheet Balsa, 1-16in. x 3in. x 36in., medium hard grade.

One sheet Balsa, 1-8in. x 3in. x 36in., medium grade.

One sheet Balsa, 1-32ndin. x 3in. x 36in, light grade.

Two sheets Jap. silk tissue.

One strip 20 gauge straight steel wire.

One block Balsa, 13 x 1½ x 1, medium hard grade.

One pair 1½ inch celluloid wheels.

Four yards ¼in. 1-32nd in. flat rubber.

Cement, dope, paste, rubber lubricant, rubber bands, washers, and an inch or so of aluminium tubing.

THE RIBS

With the wing spar and trailing edge pinned into position, we turn our attention to the ribs. The rib shape is shown on the plan. The first step is to make a template of the wing rib. This template can be of cardboard or thin aluminium, and should be exactly the same size and shape as the rib.

From the 1-32 Balsa sheet cut 13 identical ribs. Be careful to see that the grain runs lengthwise. In order to ensure all ribs being alike, they should be pinned together and sand-papered to the correct shape.

The ribs are then notched to take the main spar and leading edge, and fitted into the positions marked on the plan. It will be found that the ribs do not fit flush with the trailing edge unless they are trimmed slightly. Do not trim the ribs together, but take each one separately cut to correct size, and cement it to the mainspar and railing edge.

The leading edge is a piece of 1-8in. square Balsa and is fitted into the notches provided. The leading edge will also have to be cracked at the centre in order to preserve the sweepback.

The tips are bent from bamboo, and cemented into position. It is a good plan to bend a strip of bamboo 1-8in. wide and 1-16in. thick, to the correct shape, and then carefully cut it down the centre. Then you have two identical tips of 1-16 sq. bamboo. Use only the outside of the bamboo; the pithy centre is quite useless. Bamboo will bend easily if it is heated in a gas flame, and will retain the curve when cool.

At this stage we'll leave the wing joints to dry and turn our attention to the fuselage.

THE FUSELAGE

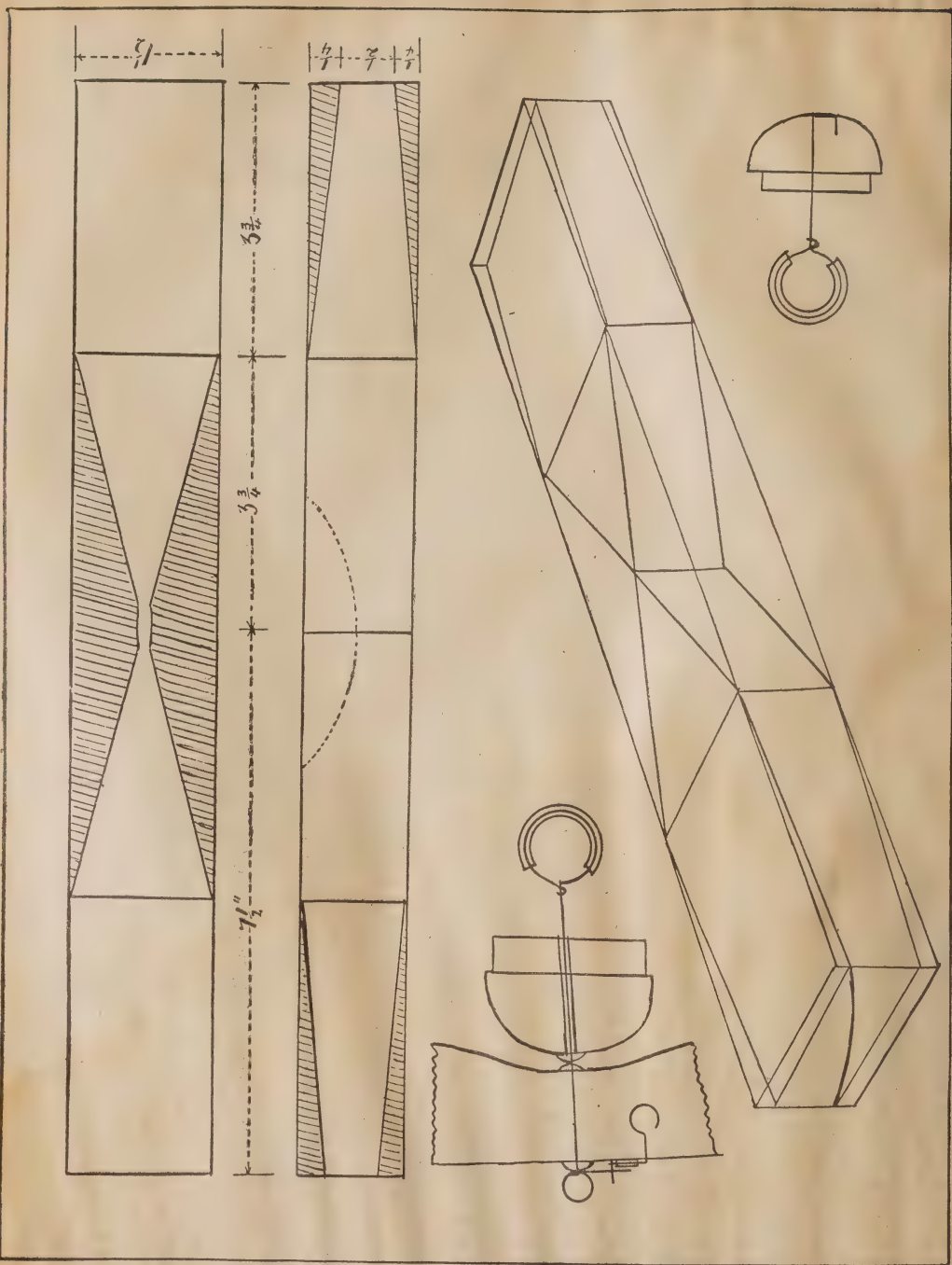
First draw the top view of the fuselage, and then remove the two sides from the plan. They will probably be cemented together in several places, and should be carefully separated with a razor blade.

Set the two sides upright on the top view plan and pin them into position. See that both sides are squarely aligned, and it is usually a good plan to support the nose with a block of wood, in order to keep it in position.

Now cut the cross struts and cement them into position. Cut them in pairs to ensure accuracy, and work on the top and bottom at the same time. When every strut is in place the fuselage framework is practically complete, and should be left to dry. The strengthening pieces around the nose and tail, and where the undercarriage fits, are put in later.

By this time the wing joints should have hardened, and we can put in the dihedral. The centre rib, incidentally, should not be cemented into place until after the dihedral has been put in.

Loosen the wing from the plan where the cement has run, and raise one tip



This is how you will make the propellor, a very important part of the completed machine. The block in which the propellor is mounted is also shown here. Take your time over this!

THE R. & H. TRAINER

(Continued from Page 65.)

six inches. Crack the leading and trailing edge to facilitate the bend, and check up on the main spar to see that it is not buckling the wing. The centre rib is then placed into position, and the joints liberally supplied with cement and then left to dry. Make sure the joint is solid and the wing is properly supported. When the cement dries, the wing frame is complete except for the incidence blocks.

While waiting for the wing and fuselage framework to dry we can make the tail group.

This is made quite easily by cementing 1-8 sq. strips of balsa on to their positions on the plan. Cut everything correct size, of course, and use 1-16 sq. bamboo tips. The stabiliser and rudder are made separately and cemented together after covering.

The nose and tail blocks are made from laminated pieces of 1-8 balsa. Cut several one-inch squares of 1-8 balsa and cement them together, crossing the grain for strength. After the blocks have dried, trim them to shape. Drill the nose to take a bushing of aluminium tubing, for the prop shaft, and fashion a tail hook of steel wire and cement it into the tail block.

CARVING THE PROPELLER

If this is your first model, you may find carving the propeller difficult. It may even be wiser to buy a partly-carved blank or get a model-building friend to help you out. Propeller carving is not very difficult if you go the right way about it, but it requires a little practice. However, if you follow these instructions carefully, you should be able to turn out a satisfactory job. (Next month, incidentally, we will run a special article on propeller carving for the beginner.)

First take the propeller block and check the measurements all round. The length should be 13 inches, the width 1¼in., and the depth 1in.; make sure the ends are square. Mark the centre of the propeller, and lay out the top view as shown on the plan. Turn the block over, and do the same on the under-side. Then drill a hole for the prop. shaft.

The shaded areas on the plan indicate the portions to be cut away before the prop. is carved. The dotted line on the side view indicates the portion cut away after the prop. is carved. The projected view is not to scale, but indicates the shape of the blank relative to the original block.

CARVING

Make sure your knife is sharp, and then start carving. Hold the block about the centre, and carve away from you; carving the right-hand corner away, work down to the other two edges. The propeller blade actually lies diagonally across the block. The leading edge of the blade being the bottom right-hand corner, and the trailing edge the top left corner of the block.

Having carved the top of one blade, turn the block around, and carve away the top of the other end. No matter what side or which blade you are working on, always hold the prop. at the centre and work right-handed, carving away from you.

When the rough carving is complete, finish the prop. with sandpaper and cut to the correct shape. Cut away the hub, as shown on the plan, and trim round the tips. If this is your first prop. leave it fairly thick at the hub, and thin down to about 1-8 inch at the tips.

The free-wheeler shown in the plan is fairly simple to make, but here again the beginner would be advised to use a fixed prop. However, make a bend in the shaft to take a geared winder if you intend to use one.

After a coat or two of dope has been applied and sanded down, the propeller is complete. Bend the prop. shaft, as shown in the plan, and insert it through the nose-block and the prop., place two washers between the nose-block and the prop., and place a washer over the shaft where it comes through the prop. This will prevent the shaft pulling back through the propeller hub.

COVERING

When the strengthening pieces of 1-32 sheet have been cemented to the nose and tail of the fuselage, and the strengthening pieces shown on the plan have been added, the fuselage is ready for covering.

During construction a slight twist may have developed in the fuselage. Therefore, check up by looking along the longerons and make sure everything is square. A very slight twist will not cause much harm. But, if you take care to keep the fuselage perfectly square while you are papering it and while the paste is drying, the paper will keep it square.

The paper should be applied to the top of the fuselage first, then the bottom, and then the sides; this will prevent the fuselage from twisting during the covering.

Cut the paper into strips wide enough to cover the area to be covered. Because of the way the grain in a sheet of paper runs, these strips will not be long enough to cover the entire fuselage, so that two strips must be used.

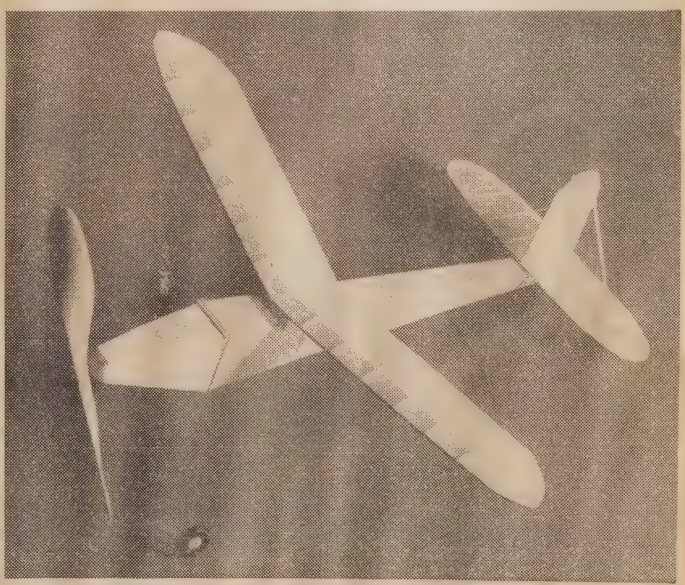
THE PASTE

Prepare paste for the covering by pouring boiling water on to a little mixed cornflour and water. This paste is very satisfactory for covering; it should be fairly thick, and it dries without leaving any mark on the tissue.

Apply paste over the longerons and struts and then place the paper on with the grain running lengthwise. Hold the paper at one end and by pulling at the other place the paper on the fuselage as tightly as possible.

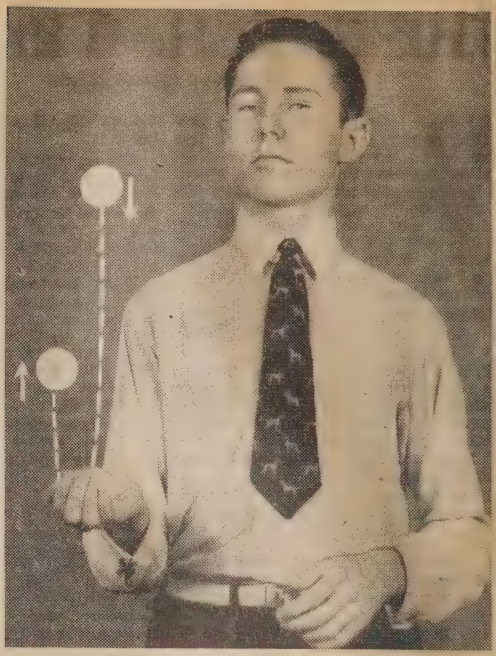
Then, starting from the end, work along the fuselage, pulling the paper tight and working it on to each strut; at the same time work out the creases. It is essential to keep the pull on the paper running the same way all the way along the fuselage, otherwise creases will result.

(Continued on Page 78)



The Finished Model

The start of the cascade. As the ball in the left hand is throw up, one from the right is tossed across to it. Before the first ball has landed in the left hand, the second has followed the first, and the third is on its way from right to left hand. The movement is smooth and circular.



Juggling with two balls in one hand. Throw one up as you catch the other. Do not throw the balls too high, and take your time. You must master this simple juggle before you can do more difficult ones with certainty. Practice it for both hands until you can keep going indefinitely.

THE ART OF BALL JUGGLING

★ HINTS BY JIMMY WALLACE

HERE Jimmy Wallace, Australia's youngest juggler, gives us our first lesson in ball juggling. About three hours' practice daily is needed. Good light is necessary—daylight is the best for exercises with the light coming from behind, so that your eyes will not encounter glare. Plenty of space is also needed, especially height. Good physical condition is a valuable asset. The first step is to take two balls in the right hand and practice throwing them perfectly vertical, throwing one up whilst you catch the other. Then do this exercise with the left hand. When you have mastered this with ease, try three balls, this time using both hands. There are two movements, one known as "cascading" and the other as "showering." When about to shower three balls, two are held in the right hand and one in the left. The first ball thrown should be sent up a little higher than the succeeding ones. Immediately the first ball is away, send the second one after it, and quickly transfer the third ball from the left hand to the now empty right. As the first ball is now caught in the left hand, the ball that has been transferred to the right must be thrown after the others as before. Keep on repeating this until you desire to stop. Do not throw too high. This is a simple juggle, but you should master it before attempting more difficult moves.

Hey Presto!

Hey Presto! Abracadabra!

Thank you, Magicians, Thank you!

It was nice of so many of you to write and say how interested you are in Magic and Conjuring as a hobby. Really, I was not aware previously that so many boys and young men—and a number of girls, too, were so keenly interested in puzzles, magic and the various novelty items I write about. But I must apologise. Owing to pressure of space in our May issue—despite the fact that the issue had to be increased to 80 pages and cover, we were unable to include "Replies to Correspondents." However, most of you will have by this received a personal letter from me in reply. In this issue, we give all the replies to correspondents outstanding at the time of printing.

In sending your questions and inquiries for advice, do not forget to enclose a fully addressed and stamped envelope for reply. There is no charge for answers and advice—write now if you have any problems regarding magic as a hobby.

I would like to receive photographs, programmes and press-cuttings of any amateur performer who would be kind enough to forward them to me. If the photographs are interesting and capable of being reproduced, we may be able to publish them in some of our future issues. Come on Magicians, send in your photographs.

In reply to several inquirers, I am pleased to say that actual photographs of magicians appearing in "Who's Who," can be obtained from me at cost-price, 1/3d each, post free. Only a limited number for each magician are available, so send NOW if you wish to obtain a photographic gallery of Magicians of world-wide fame.

With best wishes. Yours for Magic.

Barry Kent.

by Barry Kent

MAGIC

From the earliest times, the man who could do the impossible was regarded with more than a wholesome respect. It is man's reaction to things he cannot understand which gives the magician his power to mystify and entertain. In every age, and in every race, the "magic man" has always wielded his influence.

FROM whence came Magic?

Magic is probably the most ancient of all arts.

Mysterious stories have come to us through the middle ages—out of the dim records of ancient days. Wizards, witches, and necromancers of old were looked upon with awe, and they never failed to take advantage of their "magic" powers. There is no doubt that the ancient and mediaeval wizards possessed similar knowledge to that of present-day magicians. In those days, the knowledge was used in an effort to claim for the sorcerer superhuman powers. To-day, there is still a great belief in the supernatural, and many people talk of the wonders of India, China, and Egypt, and tell us stories of feats performed there, which, if presented by a modern magician in a theatre, would suffer sadly by comparison with the wonders he himself can perform.

ANCIENT MIRACLES

Mysteries have come to us from Egyptians, Babylonians, and ancient Greeks, and some of the most common of natural laws were used by them in their sorcery. The oldest recorded story of Magic comes to us through thousands of years, for it was in the year 3766 B.C. that Tchatcha-en-ankh, an Egyptian wizard, presented a seance in the Court of King Khufu. It was in those days that the Pharaohs realised the value of a magician, and they were employed for the purpose of keeping the people of the land in submission to the Pharaohs. The "supernatural" powers of the magicians were guarded by them, and they saw to it that superstition was not allowed to die. Even the rulers themselves came under the alleged magical power of the sorcerers.

NATIVE MAGICIANS

A study of anthropology tells us that present-day natives of some lands still have their witch-doctors. Their methods act as they did in the earlier days of the Pharaohs. The apparatus, as we may call it—to use the modern magician's term—of the native sorcerer consists, in many cases, of a round cane basket, about a foot in diameter and ten inches in height, which is usually lined with coconut-palm leaf. In this is a cooking-pot; a small decorated and pointed coconut receptable about three inches in length containing medicine; the lower jaw of a baby crocodile; a small bamboo tube containing black powder; a spine of a stingray; a broken skull of a small turtle; three cassowary toe-nails, and many other such odd items. How these things are used is interesting, but it is difficult to get natives to agree on any of their practices.

MAGIC OF 1939

Now, compare this "bag of tricks" with the elaborate apparatus and stage illusions of the Great Magician to-day. Present-day illusionists do not rely on superstition to create an effect. But here, I am probably going much further than I anticipated, for you, my reader, may not want to be a professional magician; probably you are interested only in a few simple yet effective items with which to puzzle your friends at your next party . . . so. turn the page, and you will find several such problems to add to your popularity and the enjoyment of your friends when next you entertain. Here's hoping.

WHO'S WHO IN MAGIC

MAURICE ROOKLYN

Introducing . . . Maurice Rooklyn, Australian magician and clever sleight-of-hand performer. Maurice returns to Australia from England in June, after three years' successful appearances in the principal theatres of England and the United Kingdom, including a television appearance in London. See his act if he comes your way. Call and met him personally.

Before leaving Australia Rooklyn appeared in several outstanding acts at various Sydney and other Australian theatres. His work has been referred to in the leading theatrical journals and daily Press overseas in such terms as: "Sleight-of-hand of extremely high order," "He need fear no rivals," "Certainly the magical high spot of the show," "A performer with a cool mastery of his art," "His work is the last word in artistic illusion," etc. Rooklyn's cleverness and high artistic ability are decided acquisitions to magic. Through his hobby and now profession, he has contributed materially to a higher public appreciation of magic, mystery, and slight-of-hand as a pleasing form of mystery entertainment.

Welcome home, Rooklyn!

Next month in "Who's Who"—The great Nicola, new in Australia.

FREE MAGIC BOOK If You Solve This Problem

HERE is a puzzling problem with a draught-board and eight draughtsmen that will keep you guessing for some time. If you do not have a draught-board, draw one on a large piece of white paper, and pencil in the draughtsmen where you think they should go. Remember, "If at first you don't succeed, try, try again." Try it out on your friends.

I will forward a Free Magic Book to the FIRST person who sends the correct answer. The winner's name will be published together with the correct solution in the next issue of "Radio and Hobbies."

HERE IT IS: Place eight draughtsmen on a draught-board in such a manner that no two men will be directly opposite one another, either horizontally or diagonally. The men must be placed correctly on squares, both black and white, and no two men in the same line—horizontally or diagonally.

CAN YOU DO THESE SIMPLE TRICKS

THE MAGIC WINE-GLASS

Left: A clever balancing trick is to balance a wine glass on the edge of a playing card. At first glance this would appear to be a hopeless task.

★

Right: Here's how. With a little care you will be able to perform this effective stunt. The forefinger provides the required support from behind.

AN IMPOSSIBLE BALANCE ★

★

You will need to practice this carefully, as some little dexterity is needed in the performance of this mystifying effect. A full glass of water is balanced with ease on its edge on the tablecloth. It is quite impossible for all except the magician when he knows how. HERE'S HOW. Place a matchstick beneath the table-cloth beforehand and unknown to your friends. Balance the glass against the match. With a little practice and care you will be able to balance the glass as shown in the photograph. Do not remove the match until an opportune moment when the audience is not looking.

CHANGING MATCHES TO HANDKERCHIEF

A full box of matches is shown by the magician. He removes one match, lights a cigarette, then closes the box. Instantly the matches disappear and a handkerchief is found in their place. See illustration at left. You will find that the matches have been cut in two, and in the other half of the box, a small silk handkerchief has previously been placed. The match you use at first is, of course, a whole one. A simple trick, but a most effective one.

NOW YOU STRONG MEN! CAN YOU DO THIS?

Here is a simple trick to try the patience of anyone. The stronger he is, the worse his patience will be tried.

Place the two sections of a match box in position as indicated in the photograph, and invite anyone to crush the whole thing with a blow of the fist.

For those of you who have never attempted this, it will seem very easy at first sight. But try it!

The two halves will spring away like magic as you touch them. No matter how hard you hit, you have little chance of striking just the right position to crush the box.

The effectiveness of this trick is accentuated by the fact that it seems so absurdly easy.

WHAT'S WRONG WITH THESE?

WASTED OPPORTUNITY

Above: Here is an example of wasted opportunity. To begin with, pictures of people—except in portrait work and casual snapshots—and pictures of native peoples,, in particular, should, so far as is humanly possible, be taken without their knowledge. Otherwise, you get this effect—everyone standing around, looking dumbly at the camera. How much better it would have been to have stolen a shot of these people going unconsciously about their work! But don't ever try to pose them; they must be stolen shots.

In this photo, too, there is a criminal amount of waste space. There is too much foreground, too much dark bulk on the left-hand side of the picture. The whole thing is out of focus. Only one thing can be done to make anything of the photograph. It should be cut as indicated. This would improve it. Nothing would make it a good picture.

I don't know, but I have a suspicion that the wrong kind of film or plate was used, also. Panchromatic is the only film that will make good photos of dark-skinned natives.

CUTTING REQUIRED HERE

Below: Here is another example where cutting wou improve the effect. If this picture was cut at t bottom and on the left-hand side so as to exclu the pool and the boy, the result would be more pleasin But why was the photo taken at all, anyway? Here t photographer had an opportunity of getting rath a pretty harbor shot. But there is practically no harb and what there is is very indistinct. A longer exposu and a smaller stop would have those boats and dista shores into plainer definition.

It is difficult to know what the photographer had mind when he took the picture; for there are fe opportunities here for pictorial effect. In other word always have some definite object well in mind befo you even think of taking a picture. Here, the res is—what?—a few trees and a glimpse of blurr water. Even if taken skilfully it would mean very litt

POOR DISTANCE

Left: Here is another classic example of indistin distances. Apparently, this photo was taken either the early morning or the late afternoon. The lighting bad; therefore the exposure should have been long It is a mistake, too, to have the horse and figu looming so largely in the foreground; the eye sprin straight to that point when, it is presumed, the pan rama was intended to be the point of interest. T introduction of such foreground effects as this mu be done very carefully, and with a great deal thought.

I am sure a better vantage point, having say a coup of well-placed trees (beneath one of which the hor and rider could have been posed) with a little searchin

CAPTURE THE MOMENT!

Camera notes by George White

A TALK ABOUT FILMS AND FILTERS

FRANK said, "Someone was telling me I ought to get a light-filter for use with my camera or something. Do you know anything about them?"

I thought it necessary to go into the matter of filters only slightly for the time being. It is a pretty wide subject, and Frank is a pretty raw amateur. I had been telling him something about focusing, so it seemed a good idea to deal with filters mostly from the focusing angle. "A red filter used in conjunction with panchromatic film," I explained, "will give you white clouds against the dark sky.

"A filter, incidentally, is a thin gelatine film of one color or another which is placed over the lens before taking the picture. Mostly, it doesn't matter whether or not you place the film in position before focusing, or afterwards. There is an exception however. If the subject is close to the camera—and in any case where a thick, or 'heavy' filter is being used behind the lens—you must do your focusing with that filter already in position."

"That is, roughly, all I wanted to know about filters. Now what's all this strange talk I hear about 'subjects and their relation to film-emulsions'?—or is that too advanced for me?"

"Not at all. In fact, it's something you ought to understand. For, unless you know something about emulsions you can't estimate correct exposures. Without going into details of speed and other differences, there are three classes of film or plate emulsions. First come the 'ordinary' films—we shall call them 'films' for convenience, although plates, roll-films, film-packs, and cut-films are included in the term. These are not sensitive to color. Then, secondly, there are orthochromatic films, and, thirdly, panchromatic.

"Your best bet is orthochromatic. There are usually two kinds. For instance, in the Selo brand, there is ordinary orthochromatic Selo and Selochrome—a rapid, backed, double-coated film. This latter type—and its counterpart exists in all brands—is probably the better, particularly for those using inexpensive cameras; for it has greater speed, and that added speed is equivalent to a faster lens.

"Whatever the camera, a brand of film of this kind can be recommended, because, on account of its added speed, a smaller stop may be used and the resulting picture will be sharper. The same applies to small cameras, where pin-point sharpness is not only desirable, but very necessary.

"Panchromatic can be recommended only to more advanced photographers. It has its very definite advantages, owing to a special sensitiveness.

"Well, the best thing to do is get on an orthochromatic emulsion—whether it's plate or roll-film—and stick to it," Frank said, rather than asked.

"Not exactly. Orthochromatic *films* are popular; therefore, the developing and printing firms who undertake to process your rolls are prepared for this type. On the other hand, photographers who use plates usually develop their own. Therefore, it is probably better for the plate-users to buy ordinary plates of a rapid kind—making sure that it is a well-known brand and one with good gradation; for these can be handled in a brighter light—and therefore, with greater comfort—than can the faster, more sensitive orthocromatic and panchromatic. The results, too, are just as good, or even better.

"So the same thing applies if you are thinking of developing your own films. Use 'ordinary' until you learn some of the intricacies. You will sacrifice something in speed; but you will make up for it in a higher percentage of unspoiled films.

"Each of these three types of films has a different speed, too. That is something you'll have to watch when you are calculating your exposure. The speed is always shown on the carton of the film and must be taken into consideration."

"Now that's something that's got me wet," he said. "I've asked a lot of people about exposures. They don't talk. You tell me."

"All right. Here it is. There's only one way to calculate a required exposure—don't do it. Over a long period and by wasting a lot of material you can learn to judge, roughly, what speed and stop to use. But the better way is to buy an exposure-meter of some kind. It need not necessarily be an expensive meter. But a meter it almost certainly must be if you want good pictures right from the jump.

"And it doesn't end there. There are three factors to consider—(1) the brightness of the image, (2) the emulsion-speed of the film you are using, and (3) the stop at which you wish to set your camera.

"You'll find provision for all these three factors on any reliable meter you buy, and full instructions how to use it.

"If you can't afford one of these—they range from a few shillings to a few pounds—you can buy a table or printed calculator which gives all the exposures for different hours of the day, under various conditions of light, and month by month as the light decreases in winter and increases in summer.

"Lens apertures—or 'stops' as they are commonly called — are adjustable. Roughly speaking, the larger the aperture the more reflected light—that is, light reflected from the subject—allowed through the lens and onto the emulsion, hence the greater the shutter-speed it is possible to use. But that's going into detail . . . we might go into that more thoroughly next week. It needs quite a bit of explaining."

Frank nodded. "Suits me," he said. "I've got enough to digest for the moment. Er—I say—could you lend me a few bob to buy some film and things?"

I was afraid of this, while expecting it. It is one of the symptoms of a photographer.

FOGGY PICTURES

Q.—I recently obtained a picture that was very foggy, followed immediately by a negative that had no picture on it at all. What is likely to have caused this? I was taking photos of breakers smashing over rocks—at pretty close range, incidentally.

A.—There is a great number of causes of foggy pictures. Perhaps the lens was dusty. But more likely it was covered with spray, rain, or mist. Taking a lens from a cold place into a warmer moisture-laden atmosphere will induce a coating of minute dew-drops on it.

Q.—Once or twice recently I have got ghostly-looking circles frequently in the shape of bull's-eyes on my negatives. Can you explain this?

A.—Very likely your lens is defective. It may possibly function satisfactorily under normal circumstances, but when it is facing a bright window, sky, or artificial light (as in night photography), these defects arise. Have it examined. Another probable cause is that the edge or rim of the iris opening, or stop may be worn bright. This will also, under certain conditions, give a flare image.

COLOR PHOTOGRAPHY

and movie cameras

Breathes there a cine enthusiast who has never reacted to that famous advertising line . . . "Load with color film instead of black and white, and your movies will be flooded with glory of gorgeous full color?"

☆

By FRANK EASTMAN

It is suggestions like this which have conjured hundreds of pounds from the pockets of cine-workers seeking the capture of true color in their films. But it was a trial and error method. In many cases their choicest scenes were washed into pale, blurry yellow by over-exposure or darkened with heavy purple shadows betraying under-exposure. But the lucky shots of their friends and the scenes caught in their true natural color were so breath-taking that they determined to persevere.

But experimenting with color film is a costly business, as many an amateur knows to his sorrow.

The purpose of this article is to save that experimenting. It will explain just how the film takes the color, what can be expected of the color film, and how to obtain the best possible results. The color film under immediate discussion is Kodachrome, unanimously voted the outstanding polychrome film on the market at the present time.

Therefore, let us assume that you are a cine-worker, who, having had reasonable success with monochrome, decide to branch out into the trickier paths of color photography.

REMEMBER!

But before you take the step, keep three points well in mind:

Color film is expensive.

Color film is "faster" than black and white, therefore greater care must be used in exposing and loading.

Color film cannot be "corrected" in the printing, as can black and white film. Nor can it be duplicated, as can happen in the case of the monochrome film. Experiments in printing off color film are now being conducted in America, but Australia has yet to find the necessary equipment for this.

Now, before we go on to the details of how to handle this film, let us see what it is we are talking about. What is color film? How does its construction differ from black and white? And how does it absorb the color from the scene? Let us then retrace our steps and glance very briefly at the history of color photography.

Seventy-eight years ago, a man named Clerk-Maxwell gave a lecture at the Royal Institute in London on his theory of color vision. In this lecture, he demonstrated that all colors may be matched by mixing in various proportions light of the three primary colors—a pure red, a pure green, and a blue-violet. He had taken three photographs, one through a red solution, one through a green, and a third through a blue solution These photographs were made into lantern slides, the images of which were projected on top of each other by three lanterns. Not only did Clerk-Maxwell project a colored picture on a screen, but he demonstrated a fact that has made possible the color film of to-day.

He showed that any required color or gradation of color could be produced by a proper mixing and adjusting of the three primaries.

Eight years later, in 1869, a Frenchman, Louis Ducos du Hauron, invented the "screen plate process." He took an ordinary photographic plate, covered the surface with tiny filters, and coated the whole with color-sensitive emulsion. White light, striking this plate, was broken up by the dozens of blue, green, and red filters, and produced a crude but recognisable direct color photograph. And it is this method, very much improved, on which the color film of to-day is based.

In Kodachrome, the separation of light into the three main primary colors is not accomplished by placing the sensitive layers side by side; they are separated in depth. Kodachrome film is coated no fewer than five times!

PROCESS

First, the film receives a coat of

Getting a close-up of Errol Flynn and Olivia de Havilland in making "Dodge City." Both Warner Brothers' stars.

emulsion, which is sensitive to red light. Next comes a layer of gelatin containing blue-green dye. The third layer is a coating of emulsion sensitive to green. The fourth is another layer of gelatin with a magenta dye. The fifth and last is a coating of emulsion sensitive to blue and containing a yellow dye.

And there we have old Clerk-Maxwell's red, green, and blue-violet lantern slides in microscopic form. For, although this film is coated five times, the total thickness is little more than monochrome.

But, you may well say, three color sensitive layers and two dye coatings on a film do not tell us how the images are seen in **actual color** when we hold a piece of exposed Kodachrome film up to the light!

The explanation for this lies in the action of the light on the film and the complex processing system. When the film is exposed, the image formed on the red sensitive layer is transformed into a blue-green positive. The image formed in the middle, or green sensitive layer, turns into a magenta positive, and the image formed in the top, or blue sensitive layer, becomes a yellow positive. Thus, our processed color film has images of yellow, magenta, and blue-green.

And, with these actual colors, or a combination of these colors, every tone in the rainbow can be reproduced. Every color picture you see, either printed or projected on a screen, is made up from a combination of yellow, magenta, and blue-green images.

So much for the construction of color film. Now let us discuss the best method of using it.

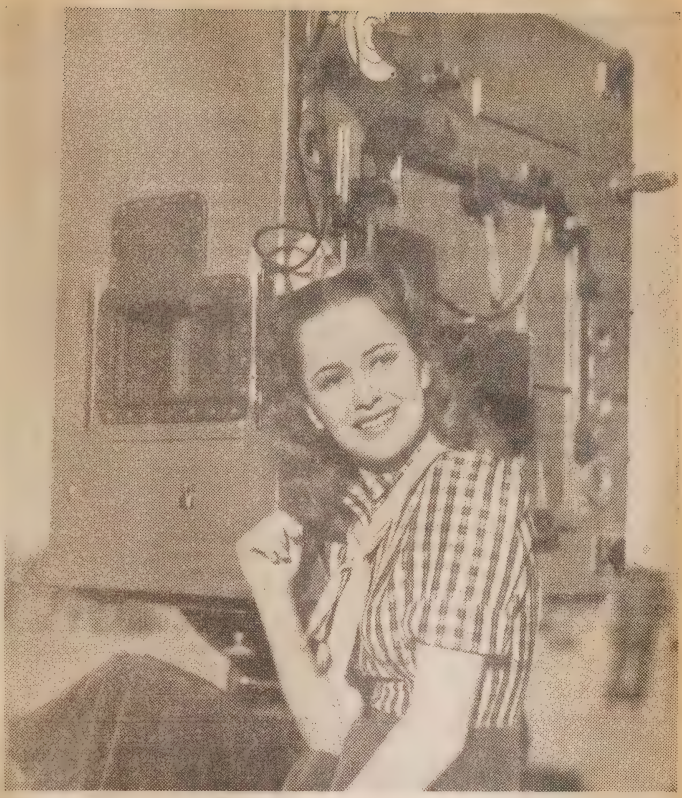
COLOR AND LIGHT

It is an elementary truth that there is no color without light. But what is not generally realised is that color is merely **reflected** light. The blue sky, the green of the trees, the vivid scarlets and yellows of the flowers, these do not change, day or night. But what happens is that at night there is no light for them to reflect. Hence, they are not seen.

So that the first point to remember is that your color film absorbs only reflected color from the various objects it photographs. Following out this premise, it is important to realise that all objects do not reflect the same amount of light under the same sky. And also that the light at two o'clock of a bright sunny afternoon is measurably different (at least to the sensitive color film) than the light at four o'clock.

So that, if, with your camera loaded with color film, you happen to see a pretty girl, attired in a bright yellow dress, and seated in a white canvas chair, you would be wise to consider this business of light reflection. Yellow and white throw off high reflections; therefore, you would be wise to stop down your camera somewhere between f.8 and f.11.

But let us suppose that you want to film this young lady meeting her young man. And the gentleman is dressed in a dark navy suit, black shoes, and black hat. Unlike his lady friend, the man reflects no light at all. On the contrary, he is absorbing light. Were you filming this man alone, you would be wise to open up somewhere between f.5.6 and f.8. But, if you expose correctly for the gentleman, you will wash out practically all the color from the lady; on the other hand, correct exposure for high light reflections will give the gentleman the appearance of a silhouette.



Olivia de Havilland shown beside one of the huge affairs known as a Technicolor camera, during the making of "Dodge City." Each such camera is worth £5000.

RIGHT EXPOSURE

Then, what to do?

First of all, avoid, if you can, such marked color contrasts as mentioned above. If you can't avoid them, then make a compromise by shooting at an intermediate stop, which, in our example above, would be f.8. You may not get true color, but neither will the figures be over or under exposed to any great degree.

An electric exposure meter is almost a necessity when shooting with color film. A "light-reading" taken just before you shoot will save many feet of film. The exposure guide accompanying each carton of color film sold is, at the best, a rough substitute for an exposure meter, since sunlight, particularly in the spring and autumn seasons, is notoriously unreliable. The writer has exposed film at three o'clock of a sunny autumn afternoon, and half an hour later exposed more footage. And, although both these lengths were taken with the same stop and under identically similar conditions, the color values were quite different.

UNIFORM COLOR

Uniform color matching is essential to a good film. Nothing tires the eye so much as watching a screen that plunges from light tones to dark tones without warning. And just to prove that the experts as well as the amateurs have their troubles in this direction, James Sherlock, considered the outstanding cine amateur in Australia, told me that in making his color film, "To the Ships of Sydney," he destroyed 2000 feet of color film because of the difficulty of matching the tones of his shots.

So much for exposure.

Don't try to make your color film encompass too much. This applies particularly to 8 mm. workers.

One of the minor drawbacks to color film is the great difficulty of getting sharp images in the long shots. Distant figures always seem slightly blurred or out of focus and this is due, not to any mechanical defect in the camera, but to the extra thickness of the color film.

MOVIE CLUB NOTES

FINE TRAVEL FILMS

Some outstanding travel films, the work of Mr. H. G. Spry, entertained members of the Australian Amateur Cine Society at the meeting of April 17 at Science House. Mr. Spry is a professional showman, connected with Luna Park, Manly, and other attractions, and this professional touch extended to his very entertaining films.

The first film opened with the Shriners parade in America, and the lavishness of the men's fancy uniforms, filmed in color, was most impressive. The scene then shifted to Honolulu, where the surf-board sequences were particularly good. The Dutch East Indies and Singapore wanderings occupied the next two or three reels. The dancing ceremonies at Bali were especially outstanding, and with these were shown the wonderful home of "The Tiger Man" in Singapore.

Mr. Spry accompanied the screening with appropriate disc records, and used the microphone for a running commentary during other portions of his films.

Other meetings of the May month were well attended, and two of the highlights were a selection of films, "My Trip Through America," by A. W. Skidmore, and a programme of talkie shorts, arranged by courtesy of Gaumont British.

MR. E. JACOBS

A great loss to amateur cine circles is occasioned by the death of Mr. E. Jacobs, the donor of the annual Jacobs Cup, for the best film of the year.

The late Mr. Jacobs had been in poor health for some time, and for that reason was forced to relinquish his interest in amateur cine circles. He was an early member of the A.A.C.S., and screened his films regularly at the society's meetings.

The president of the A.A.C.S. (Mr. Roy Booth) forwarded a letter of condolence to Mrs. Jacobs, expressing sympathy on behalf of himself and the members of the society.

FRENCH CUP

A Poor Response

Mrs. Brooks Wins

There was a rather disappointing response to the French Cup competition, for the best 100 feet of film taken at the St. Ives Show.

Despite the lure of a silver cup, only three competitors entered. One failed to put in an appearance, leaving Mrs. K. Brooks (16 mm.) and Mr. R. Taylor (8 mm.) in the field. The cup went to Mrs. Brooks. Her film was particularly well titled, and this added considerably to the thoughtfully arranged shots.

Mr. Taylor lost points on his titles compared with the winner, but his film was evenly exposed and gave one an excellent idea of the Show generally.

Mr. H. Mallard acted as adjudicator.

A very generous offer has been received from Mr. K. A. Blyth, of the Queensland Cane Growers' Council, who was a guest of the A.A.C.S. when he visited Sydney at Easter. This is a copy of the film, "The Australian Cane Sugar Industry," on two 400-foot reels.

The film is made available on loan to the A.A.C.S. library for a period of six months as from May 1.

Reading a MICROMETER

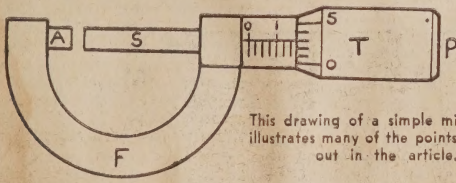
Anyone who works to fine limits has, sooner or later, a use for a micrometer. It is a simple instrument, but one must be able to use it properly to find it so. This article tells you something about the simple type.

THE micrometer caliper, micrometer, or merely "mike," as it is known to the engineering fraternity, is the most accurate measuring instrument to be found in the workshop.

The diameter of a human hair or the thickness of a cigarette paper will be indicated clearly to within fractions of a thousandth of an inch of accuracy. A few turns of the thimble on this remarkable instrument and we may measure to the same degree of accuracy the diameter of a piston or crankshaft.

HOW IT OPERATES

The spindle S is attached to the thimble T, on the inside at the point P. The part of the spindle which is concealed within the sleeve and thimble is threaded to fit a nut in the frame F.



This drawing of a simple micrometer illustrates many of the points brought out in the article.

The frame being held stationary, the thimble T is revolved by the thumb and finger, and the spindle S being attached to the thimble revolves with it, and moves through the nut in the frame, approaching or receding from the anvil A. The article to be measured is placed between the anvil A and the spindle S. The measurement of the opening between the anvil and the spindle is shown by the lines and figures on the sleeve and the thimble.

The pitch of the screw threads on the concealed part of the spindle is 40 to an inch. One complete revolution of the spindle, therefore, moves it longitudinally one fortieth (or twenty-five thousandths) of an inch. The sleeve is marked with 40 lines to the inch, corresponding to the number of threads on the spindle. When the caliper is closed, the bevelled edge of the thimble coincides with the line marked O on the sleeve, and the O line on the thimble agrees with the horizontal line on the sleeve. Open the caliper by revolving the thimble one full revolution, or until the O line on the thimble again coincides with the horizontal line on the sleeve; the distance between the anvil and the spindle is then 1/40 (or .025) of an inch, and the bevelled edge of the thimble will coincide with the second vertical line on the sleeve. Each vertical line on the sleeve indicates a distance of 1/40 of an inch. Every fourth line is made longer than the others, and is numbered 0, 1, 2, 3, &c. Each numbered line indicates a distance of four times 1/40 of an inch, or one-tenth.

The bevelled edge of the thimble is marked in twenty-five divisions, and every fifth line is marked from 0 to 25. Rotating the thimble from one of these marks to the next moves the spindle longitudinally 1/25 of twenty-five thousandths, or one thousandth of an inch. Rotating it two divisions indicates two thousandths, &c. Twenty-five divisions will indicate a complete revolution, .025 or 1/40 of an inch.

TO TAKE A READING

Multiply the number of vertical divisions visible on the sleeve by 25, and add the number of divisions on the bevel of the thimble, from 0 to the line which coincides with the horizontal line on the sleeve.

For example, as is represented by our sketch, there are seven divisions visible on the sleeve. Multiply this number by 25, and add the number of divisions shown on the bevel of the thimble 3. The micrometer is open one hundred and seventy-eight thousandths.

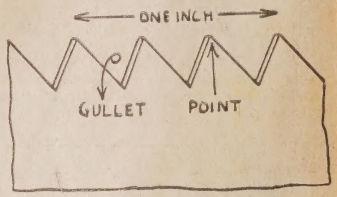
The article should be held lightly between the anvil and the spindle; too much pressure may strain the micrometer or, perhaps, even squeeze the article to a certain extent and thus inaccurate measurements are indicated. To avoid this possibility some instruments are equipped with a ratchet extension on the sleeve which ensures the same correct degree of pressure for all points of contact when measuring. A locking device for the thimble is another feature of some jobs. This enables the micrometer to be handled without fear of altering the setting.

Keep Your Wood-Saw Fit!

Saws will cut only if they are sharp. Not everyone can sharpen the ordinary wood-saw. Read this article, and you will probably learn something which will help to improve your work.

WOODWORKING of almost every description calls for the use of a woodsaw; the neatness of the finished job depends mostly on the condition of the saw.

It is not necessary to re-set the teeth of a good quality handsaw every time it needs sharpening. If the teeth are touched up with a file from time to time



it will cut longer and better, and sufficient set will remain to enable the saw to clear itself.

JOINTING

If the points of the teeth are not all of the same height the set can never be regular and it is necessary to "joint" the saw until the teeth are all of equal height. To do this we clamp the saw between two pices of wood and pass a smooth flat file of about 10-inch length lengthwise along the tops of the teeth, until it touches every tooth.

SHAPING THE TEETH

After jointing all teeth must be filed to the correct shape. The "gullets" (between teeth) must be of equal depth and the fronts and backs of the teeth should be properly shaped. To do this we use a three-corner smooth file, placing it well down in the gullet and filing straight across the saw at **right-angles** to the blade. If the teeth are of unequal size, press the file against the teeth having the largest tops until you reach the centre of the flat top made by "jointing," then move the file to the next gullet and file until the rest of the top disappears and the tooth has been brought up to a point.

SETTING THE TEETH

The teeth of a saw are "set"; this means that the upper half of each tooth is bent slightly sideways in the oppo-

(Continued on Next Page)

THE R. & H. TRAINER

(Continued from Page 67)

The bottom and sides of the fuselage are covered in a like manner, and the framework left to dry. This may take several hours, due to the slow drying paste.

THE WING

The wing covering is slightly more difficult, due to the curve of the wing ribs, but with care a good job will result.

Cover top and bottom of the wing with the grain running lengthwise, and stick the paper to each rib. Leave the paper to dry, and later trim the edges with a very sharp razor blade.

The tail covering is quite simple, but do not attach the paper too tightly. The tail is only covered on one side, and if the paper is tight the tail may warp. On no account should the tail be doped—this will inevitably lead to warping.

When the tail covering has dried cement the fin into position and glue a supporting strut on each side of the fin.

UNDERCARRIAGE

The undercarriage consists of a single piece of wire bent to the shape shown on the plan and fixed to the fuselage by means of retaining pieces of 1-8th square balsa. Two pieces of 1-8th square balsa are glued across the top of the fuselage immediately above the deepest part of the fuselage. The struts project a little over the sides of the fuselage and the top of the undercarriage fits between them.

Two other pieces are glued across the bottom of the fuselage, projecting so that they hold the lower part of the undercarriage. A rubber band across the bottom of the fuselage holds the whole thing in place.

The wing is attached by means of rubber bands and hooks. First incidence blocks cut from 1-8th balsa, the front one being 3-16th inch higher than the back, are made, and glued to the wing. Pins are bent to form small hooks, and cemented into these blocks, and the rubber bands pass from these hooks around the fuselage and hold the wing in place.

The tail is attached in a similar manner, by attaching small pieces of 1-8th square balsa under the stabiliser and inserting hooks.

FLYING

Now we cover the prop shaft with rubber tubing to prevent it cutting the elastic motor. Then loop the elastic so that it makes six strands, coat with plenty of rubber lubricant, and the model is ready to go places.

Find the balancing point of the model and then place the wing so that this point comes immediately below a point 1-3rd back from the leading edge.

Check over the model carefully and make sure the wing and tail are lined up squarely. See, too, that there are no warps in the wing, tail, or fin. The only adjustment need should be a little right rudder. Twist the rudder to the left so that the model will turn to the right and overcome torque.

Glide the model gently, pointing the nose down slightly. Do not throw the model hard, but give it sufficient speed to fly. If the model dives move the wing forward a fraction. If it stalls and then dives move it back slightly.

When the correct glide has been achieved wind on a hundred turns and give the model a hand-launched flight. The model should fly without any sign of a stall; however, if a stall is present give the model a little more down thrust by placing a piece of 1-16th balsa between the top of the nose block and the fuselage. If the stall still persists move the wing back a little more.

The turn may be controlled by adjusting the rudder.

When test flights have been completed give the model about 500 turns—stretching the motor will add turns. Place it on the ground and watch it rise from the ground and go places.

A rubber band around the nose block will prevent the prop falling out and thereby improve the glide.

KEEP YOUR WOODSAW FIT!

(Continued from Previous Page)

site direction to its neighbor. It is always necessary to set the teeth after you have jointed and shaped them. The teeth of a saw should be set before the final operation of filing in order to avoid injury to the cutting edges.

Setting causes the saw to cut slightly wider than the saw blade. This gives clearance to the blade and prevents friction and jambing. The depth of the set should not go, at the most, lower than half the length of the tooth. If deeper than this the teeth may break off and the blade may buckle. Soft, wet woods require more set and coarser teeth than hard, dry woods. For fine work on either material, it is best to use a saw with fine teeth and little set.

A "sawset" is the best tool for amateur saw-setting. This is a plier-like device which is quite easy to manipulate and ensures even and correct work. The upper half only of each tooth should be sprung over, one to the right, one to the left, and so on, alternately, right along.

FILING THE TEETH

This is the fourth and final operation of a saw overhaul.

For crosscut saws place the saw in the clamp with the handle at the right. Start at the point or end and pick out the first tooth that is set towards you. Place the file in the gullet to the left of this tooth. Hold the file directly across the blade then swing the file-handle towards the **left** for about 45 degrees. Do not allow the file to tilt upward or downward. Be sure the file sets well down in the gullet and let it find its own bearing against the teeth it touches. The file should cut on the push stroke and files the tooth to the left and the tooth to the right at the same time. Skip the next gullet to the right and place the file in the next gullet towards the saw handle. Repeat the filing operation, being careful to file at the same angle as before. Continue this way, placing the file in every second gullet, until you reach the handle end of the saw.

Now turn the saw around in the clamp handle to the left and place the file in the gullet to right of the first tooth set towards you. (This is the first of the gullets you skipped when filing the other side.) Turn the file handle to the **right** this time and file as before alternately until you reach the handle.

The same method is used for filing ripsaws with one exception; the file should be held straight across the saw at right-angles to the blade and kept this way for both sides.

Moisture against a steel face means immediate rust. When you finish with a saw rub it down with an oiled rag. If the blade is already rusted first rub it down with fine emery cloth before oiling. Always hang a saw so that other tools will not knock against the teeth and injure them.

ANSWERS TO CORRESPONDENTS

PHOTOGRAPHY

Q.: There are a few queer markings n the surface of some of my negatives. 'an you suggest what they are and how ney came to get there?

A.: They might have got there in one r more of any number of ways. Furhermore, it all depends on what the narks look like. The chances are, owever, that whatever they are, they ot there during developing, or handing of the film. Great care should be aken of films and negatives; if your ingers come into contact with them—articularly if your fingers are damp—narks will be left on the surface. These re easily recognisable. If the marks re scratches, these are probably due to irt in the developer, or undissolved hypo rystals in the fixing bath.

Q.: What, exactly, is "fog," and how s it caused?

A.: Fogging is a term applied to negaives. It takes the form of a more or less ense black patch like a thin cloud. his, of course, reproduces white on the rint. There are two kinds of fog—ne is caused by the action of light n an undeveloped film (or partly deveoped—that is, the action of light on a lm **during** development); the other is aused by chemical action. Both may be ocal or general.

If there is a small leakage of light n the camera, fog will be caused on ne spot of the negative; if the leakage s large the fog may cover the whole egative. A bad safe-light, or a lightaky door or window will cause fogging uring developing—this will affect the hole of the negative's surface.

Over-exposure will give the negative n appearance of fogging. An underxposed negative subjected to an eneretic developer for an undue length of ime will produce a fog over the enire negative. The trouble will also rise from too much alkali or too much ulphite in the developer. The same hing will occur if the developer temerature is too high, or the chemicals re impure, or the dishes are dirty.

Q.: What causes blisters on a negaive? Tell me that.

A.: Blisters are caused by a sudden hange of temperature. For example, if, rom a comparatively warm developer ou plunge your negative into a cooler xing bath, blisters will result. The ame thing is likely to happen if your egative goes from an extra strong ypo bath into plain water. Excess lkali in the developer is another freuent cause of this trouble.

Q.: What makes negatives "frill" along he edges?

A.: Frilling or puckering along the dge of a film is generally attributable o too much handling of the film, especially with hot fingers.

Q.—What, exactly, is halation?

A.—True halation is caused by light passing through the film, reaching the back of the plate, and from there being reflected to the under surface of the sensitive film coating. When the film is developed this reflected light gives a foggy appearance to the affected part and makes for bad definition. If you use a backed plate or film this cannot happen.

Q.—What causes a patch of fog bang in the middle of a negative?

A.—It's hard to say without seeing the negative and the camera. In some cases this has been traced to the closing up of a folding camera so that the bulb or shutter trigger has been accidentally pressed. Thus, the shutter has opened while the lens was close to the film. A central patch of fog results.

Q.—It's amazing! I recently developed a film and instead of obtaining the usual and expected negative, a positive image came up. What?

A.—It looks as though you've given a normal development to a badly over-exposed plate. On the other hand, you might have over-developed a badly under-exposed plate in an unsafe darkroom light. The same thing will happen if you continue development after a partially-developed plate has been exposed to white light. It all depends on the degree of positiveness. However, I think you'll find that one of those faults fits the occasion.

STILL THEY COME!

Here are a few more enthusiastic comments from our readers. We have received far more than we can answer here. Next month we hope to have more space to deal with our mail bag.

B. W. Pearson, New Angledool: "I received my new copy of Radio and Hobbies in Australia almost a fortnight ago, and as I have been a reader and a student of "Wireless Weekly" for about ten years I naturally expected something out of the box and I'm putting it mildly when I say that my expectations were surpassed. It is a grand little magazine."

Bert Stoker, Crabbes Creek via Lismore: "I found it very interesting."
John Butler, 263 O'Sullivan-road, Bellevue Hill: "Here is a note expressing my heartiest congratulations on your excellent publication; it is a credit to the Editors, and the answer to a long-desired requirement by the radio enthusiasts throughout Australia. Please keep up the standard set and it will be the only radio monthly worth obtaining."

S. V. Ellis, 86 Loch Maree-street, Maroubra: "The new book is fine."
K. Stevens, King's School, Parramatta: "I like very much what I have seen of Radio and Hobbies."

J. F. Langford, 63 Ridge-street, Greenslopes, Q.: "There is only one regret; it being a monthly instead of a weekly publication."

R. L. Ferguson, "Stathins," Beckom: "It is a jolly good sixpence worth."
A. R. Fisher, 5 Kirkdale-street, East Brunswick, Vic.: "It is a good book."
O. Lansbury, 24 Undercliffe-st., Neutral Bay: "I think it is far the best radio magazine ever published in Australia."

MAGIC

Replies To Correspondents

Kevin Coyne, Laidley, Queensland.—Glad to hear of success. See our June issue. Will obtain full list for you and forward.

George Conobolas, Casino.—Illusion mentioned is similar to Indian Rope Trick. Congratulations on juggling performance. Will forward egg trick.

Norman Hooper, Kensington, Vic.—Thanks for wishes. Will forward list of books earliest opportunity. Write again.

N. Jones, Gladstone, Q'land.—Glad you found article of interest. Will send list of apparatus soon, also address of penfriend. Mr. Jones would like penfriends interested in magic, about 17 or 18 years of age. Address, Toolooa-street, Gladstone, Qld.

Cyril B., Brisbane.—Thanks for letter. Cannot supply illusion mentioned, but can obtain blue-print with full instructions. Will write later.

Miss Joan Hanlon, Unley, S.A.—Will ascertain name of Magicians' Club in Adelaide and forward in due course. Glad you liked article.

"Bellboy" Crookwell, N.S.W.—Trick can be obtained from any magical dealer in Sydney. Be careful with chemical tricks; would suggest you discontinue experiments until you are a little older.

Walter Fleming, Petersham.—The Imps Club of Sydney is club mentioned. They hold magical concerts periodically. Will ascertain and write.

(Continued on Next Page)

RADIO

L.H. (Bondi) has a set on which he can't get a certain two locals no matter what he does.

A.: It may be that your position is very bad for these stations, and that even the best of sets won't be able to receive them satisfactorily. If yours is a modern set of five or more valves this would seem to be the case. If not, then it may not be in good order. If you suspect this, a visit to the service man is indicated.

A.G. (Waverley) wants to use Little Jim on a speaker.

A.: To do this, you would need to rebuild the set so as to add an audio stage. This would double the cost of the set, and entirely alter its present form. A resistance coupled output pentode such as the 42 would be required, with a regular power supply and dynamic speaker. From your letter we don't think you had such drastic alterations in mind.

H.M. (Waverton) wants to know how he would find exactly 22.35 metres on his set.

A.: It is not easy to spot stations as closely as this on an ordinary set. The best you can do is to mark the positions of stations which give their wave-lengths and make a rough estimate from these positions. In production, it would be very hard to mark the dial with calibrations so accurately that we could split up metres. You could divide the space between 19 and 25 into six equal divisions, and treat each one as a metre—this would approximate it, anyhow.

C.R. (Sandgate) is another who likes our paper.

A.: Thanks for your complimentary remarks. We intended to run the description of a cheap microphone in an earlier issue, but it never got into print. We will make an effort to cover it in our next issue.

W.J. (Mia Mia) wants a book which will tell him something about the elementary things of radio.

A.: We still have some of our original Radio Handbooks at the office, one of which you can obtain on sending 1/- in stamps. It was an excellent book for the beginner in radio. Thanks for your nice remarks about Radio and Hobbies.

K.F. (Glenbrook) writes to say that Radio and Hobbies is the magazine of the century!

A.: Spare our blushes! The circuit you send could be worked from A.C., but we doubt whether it would be cheaper than batteries. You could use a 6C5 as the detector, and light the filament from a small transformer. Keep to the B battery, however, as it will be cheaper than building a power supply for such a small drain. Can't understand your question about the condenser.

J.R. (West Australia): Many thanks for your nice letter—glad you like the short-wave notes. Don't know about the medium wave guide, as it is the short-waves readers of that section are most interested in. However, it's an idea.

W.B. (Ewington): There are several firms in Sydney who sell these motors. They cost about £5 or £6 each. If you like we will put you in touch with one of them. We have no contributor of that name, but if you send your inquiries direct to the Editor of Radio and Hobbies we will try to get them answered for you.

H.G.E. (Atherton) inquires re an electric fence constructional article.

A.: We went carefully into the matter of the electric fence, but it was evident on looking into it that the problem was not so easy as it may seem. The unit itself would really have to be made so completely, that the constructional work would be a matter of assembly only, and little would be gained. The design and construction of the transformer and contact assembly isn't easy, as with poor design and workmanship the running costs could double and treble themselves in no time. Still, we have it in mind.

H.B. (Thirroul) asks re remote control units for pick-ups.

A.: We are thinking of running such a unit in an early issue, but there are several points we wish to clear up first—the main one being the matter of interference with other receivers. There is grave risk of this if the greatest care is not taken. The units are quite easy to make, and if we can satisfy ourselves that they are successful and desirable, we may be able to do something about it.

S.C. (West Croydon) writes regarding the dropping resistor method of obtaining screen voltage.

A.: Yes, it is quite in order to use dropping resistor to obtain the scree voltage. We suggest that you use 50,000 ohms resistor or thereabout which should be about right for the s you are using. Hope you have succe with the set.

T.B. (Leichhardt) wants to know abo amateur transmitting.

A.: Yes, you would have to get licence, all right. Write to the Rad Inspector, Haymarket Post Office, f full details of the examination. T Aust. Radio College has an excelle course for amateurs, and you would well advised to write for informatio We will pass your name to the secreta of the club you mention.

Radio Fan (MacLeay River), has set which developed a volume contr fault—couldn't turn the volume dow properly. When turned "on," the s howled and whistled.

A.: Looks like the control has an ope circuit in the earthed end. Failir this, the connection to earth at th end has come away from the chass The remedy is first to inspect for t broken lead, if any, and second, test the control for continuity. If is a "dud." don't play round with it fit another one, and the trouble shou disappear.

H.C.J. (Goulburn) wants to kno whether he should buy an A.C.-D. set, or a D.C. set.

A.: We don't think there would any difference in performance betwee the two sets. It would be much handi to have the A.C.-D.C. set if there is a chance of you moving into an A.C. are The D.C. set would have to be rebui if you did. Thanks very much for yo nice remarks.

A.C. (Harbord) has a 2JU five. T grid on the beat side of the 6A6 h developed a short to the cathode, a he wants to use two separate valv in place of the 6A6, as he has a pa of 6C5's on hand.

A.: Yes, you can use the two valve but provide another socket hole o the chassis. Treat the beat oscillat valve just as though it was the secon half of the 6A6. For coupling, we su gest a tiny condenser from the 6 plate to the detector grid. Half-an-inc of twisted Belden as a condenser shou be plenty. There is no need to remo the 6A6—you can still use the good ha for a detector.

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